THE WINSTON CHURCHILL MEMORIAL TRUST OF AUSTRALIA

REPORT BY JENNIFER EDMONDS
OFFICE OF RAIL HERITAGE
CHURCHILL FELLOW, 2007

An investigation into the preservation, conservation, operation and maintenance of steam locomotives on heritage railways and in museums.

Battle of Britain class locomotive *Winston Churchill* on display in the National Railway Museum in York, UK.

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It would also not have been possible without the support of my colleagues and volunteers at the Powerhouse Museum, whose hard work, passion and dedication made it possible for me to travel overseas for such an extended period of time, and know that the work on our own project would continue.

A big thanks also must go to my husband, who travelled with me, navigated the unnavigable, lugged baggage through the impenetrable and took all the photos. He was also invaluable in providing lively debate and discussion throughout to help in the formulation of this report.

And—of course—a huge thank you to all the organisations, staff and volunteers listed below who rearranged their schedules to see me, organised side trips, showed me their operations, and so generously shared their time and their wisdom. This entire report is only possible because of their unstinting assistance, their passion and their infectious enthusiasm.

Thank you for showing me that great things are possible, despite the odds ...

Meiningen Dampflokwerk	Uwe Leifheit
Harzschmalspurbahn	Tobias Kascha
Rigibahn	The steam staff (who speak no English, put up with my awful German, and *still* don't know I was engaged in a field study)
Le P'tit train de la Haute Somme	David Blondin
North Yorkshire Moors Railway	Phil Crawshaw and the drivers and firemen, and shed and depot staff and volunteers
National Railway Museum (York)	Helen Ashby Anthony Coulls Jim Rees Rod Lytton
Gordon Newton Engineering	Gordon Newton
Ffestiniog Railway	Jon Whalley Peter Lawson Paul Leuwin
Welsh Highlands Railway (Porthmadog)	Staff and volunteers
Talyllyn Railway	David Scotson and shed staff and operating crews
Boiler Engineering Skills Training Trust	Andrew Semple
Severn Valley Railway	John Robinson Graham Beddows

Tyseley Locomotive Works	Bob Meanley
King Edward 1	Martyn Bane all the operations volunteers
West Somerset Railway	Mark Smith Andrew Forster Paul Conibeare and the workshop staff and operations crews
The Beeches Light Railway	Adrian Shooter
Bluebell Railway	Chris Shepherd and the shed staff
Cass Scenic Railroad	Fred Bartels Driver Dirk and Fireman Jerry
Strasburg Railroad	Kelly Anderson and the workshop staff
Pennsylvania Railroad Museum	Bradley Smith
Society for Industrial Archeology	Mike Hamilton
Museum of American History (Smithsonian)	Robert Vogel (retired) William Withuhn David Haberstich
Durango and Silverton Railway	Steve Jackson Melissa
California State Railroad Museum	Paul Hammond Ellen Halteman Kyle Wyatt Pamela Horan and all the staff and volunteers
Brooklyn Roundhouse	Ed Immel Doyle McCormack and the rest of the 4449 crew

A huge thank you also to Mark and Pat Smith, Adrian and Barbara Shooter, Mike Hamilton and Laura Golberg, and Ed and Rachel Immel, who provided great company, beds, food, chauffeuring services and/or laundry facilities—all of which was very much appreciated!

INTRODUCTION

This fellowship allowed me to travel to 39 different organisations in Germany, Switzerland, France, the United Kingdom and the United States of America to study steam locomotives in preservation—their conservation, interpretation, reconstruction, operation and maintenance.

The aim of this fellowship was to bring information back to Australia to assist heritage railway organisations—particularly those running steam locomotives—to improve their standards of workmanship and maintenance, and the viability of their overall operation. This examination included the workshop facilities necessary to allow each group to carry out their own repairs and maintenance, the training of staff and volunteers, the placement of staff and volunteers, and the general running of the railways.

I was particularly interested in the safety regulations that each organisation must conform with in order to operate; Australia has no across-the-board regulations yet on either boiler or mechanical practices, and a number of operators (both main line and branch line) are engaged in unsound and unsafe practices.

It was also my aim to help railway museums improve their standards of conservation, develop new and innovative methods of presenting and interpreting their objects for the general public, and develop systems and structures to assist in determining the correct philosophy to use on each object.

Although I had not intended to do so originally, I realised that it would be useful to determine the funding that each of these organisations had available to them, in the hope that organistions in Australia might be able to develop some funding streams to help them with the increasing costs of keeping steam-hauled railways operational.

Above: The volunteer engine crew on the Talyllyn Railway have just finished filling *Talyllyn's* water tanks.
Below: The Durango & Silverton train winds its way around the horseshoe bends on its trip to Silverton.

EXECUTIVE SUMMARY

Jennifer Edmonds
Heavy Engineering Objects Conservator
100 Queen St, Concord West, NSW 2138
0412 352513
jledmonds@optusnet.com.au

My Churchill Fellowship encompassed travel to Germany, Switzerland, France, the United Kingdom and the United States of America between 20 July and 2 November 2008. The aim of the fellowship was to visit heritage railways and museums with steam locomotives, either as static exhibits or in operation, to see how similar organisations in Australia might improve their own practices of collection, conservation, interpretation, reconstruction, operation and maintenance, and how they might fund these improvements.

I focused on heritage railways that operate intensively, and therefore have a solid maintenance and refurbishment regime, and museums with high visitation. To this end I visited a number of heritage railways that are purely commercial operations run entirely by paid staff, some run solely by volunteers, and others with a mix of both. I met with branch-line railways as well as main-line operators, museums that have only static rolling stock, museums that operate their own rolling stock and operators with their own museums. I also visited a number of steam locomotive and/or boiler manufacturers and repairers, to view the kinds of equipment they have available to them and the kinds of work they are able to produce that is currently impossible in Australia due to a lack of space, skills and equipment.

Recommendations
In order for heritage railways to operate in a safe and sustainable manner
I recommend that government:

- Set aside some of the money made from national lotteries and use this to fund heritage projects
- Implement a mandatory, enforceable, national set of regulations in boiler management and mechanical management of steam locomotives that would be required across the board for main line and branch-line operations
- Set up a national body to inspect and enforce these regulations
- Implement training schemes in boilermaking and mechanical fitting in line with the regulations or fund a series of traineeships to send appropriate candidates overseas to learn skills
- Set up mentoring groups where organisations with the skills and understanding of the regulations can assist fledgling organisations by providing support and information

I recommend that heritage railways:

- Develop and implement a philosophy for operation and each piece of rolling stock
- Set up a network of maintenance workers with regular, informal meetings to share information
- Ensure a thorough understanding of the safe operation of their railway and rolling stock
- Ensure they have a thorough understanding of their responsibilities, the regulations and are able to implement them
- Ensure that paid and voluntary staff are qualified for the work they are doing
- Implement training schemes for both paid and voluntary staff to ensure skills transfer
- Implement a system of paperwork to track faults and repairs
- Ensure that money is available for repairs, maintenance and overhaul of rolling stock

I recommend that railway museums:

- Develop an organisational philosophy
- Develop and implement an appropriate collections policy
- Develop and implement an appropriate philosophy for each object

Implementation and Dissemination
The information within this report was collected to assist railway organisations inform themselves of best practices overseas, so that they may take those lessons most useful to them and implement them in a manner most applicable to their groups.

This report will be sent to the Office of Rail Heritage, the Association of Tourist and Heritage Railways Australia and the Australian Railway Association in the hope that some of the broader concepts within this report may find support within government bodies and organisations.

The information gathered for this report can be presented to heritage rail industry forums and railway groups on request, and further information will be made available where possible through industry journals and magazines.

Program of Study

Germany

23 July	Meiningen Dampflokwerks (Meiningen Steam Locomotive Works)
24-25 July	Harzschmalspurbahn (Harz Narrow-Gauge Railway)—Wernigerode
29 July	Deutsche Bahn Museum (German Railway Museum)—Nuremberg
30 July	Munich Transport Museum

Switzerland

1 August	Lucerne Transport Museum
2 August	Rigibahn (Rigi Railway)—near Lucerne
4 August	Brienz-Rothorn Bahn (Brienz-Rothorn Railway)—near Interlaken
6 August	Schynige Platte Bahn (Schynige Platte Railway)—near Interlaken

France

8 August	Cité du Train (French National Railway Museum)—Mulhouse
15 August	Le P'tit train de la Haute Somme (Narrow-gauge railway)—Froissy

United Kingdom

25 August	Beamish Open-Air Museum—Beamish
26 August	Locomotion (Museum)—Shildon
29/31 August	North Yorkshire Moors Railway
1-3 September	National Railway Museum—York
4 September	Gordon Newton Engineering—Bradford
5/7 September	Welsh Highlands Railway—Caernarfson
6 September	Talyllyn Railway—Pendre
8 September	Welsh Highlands Railway—Porthmadog
8-9 September	Ffestiniog Railway—Boston Lodge, Porthmadog
10 September	Boiler Engineering Skills Training Trust Chairman
11 September	Severn Valley Railway—Bridgnorth
12 September	Tyseley Locomotive Works—Birmingham
13-14 September	King Edward I—Bristol
15-16 September	West Somerset Railway—Williton, Minehead
17 September	Roger Pridham & Sons Engineering—Tavistock
21 September	The Beeches Light Railway—Oxfordshire
23 September	Bluebell Railway—Kent

United States

26-27 September	Cass Scenic Railroad—West Virginia
28 September	Franklin Institute of Science—Pennsylvania
30 September	Baltimore & Ohio Railroad Museum—Maryland
1 October	Talk to the Society of Industrial Archeologists—Washington DC
2-3 October	Strasburg Railroad—Pennsylvania
3 October	Pennsylvania Railroad Museum
7 October	Museum of American History (Smithsonian), visit and talk—Washington DC
11-13 October	Durango and Silverton Railroad—Colorado
21 October	Jamestown Precinct—California
22-24 October	California State Railroad Museum
25-26 October	Brooklyn Roundhouse—Oregon
27 October	Oregon Museum of Science and Industry

THIS REPORT

Much of this information is relevant in a number of contexts and could have logically be found under a number of different headings; I have tried, where possible, not to repeat the information.

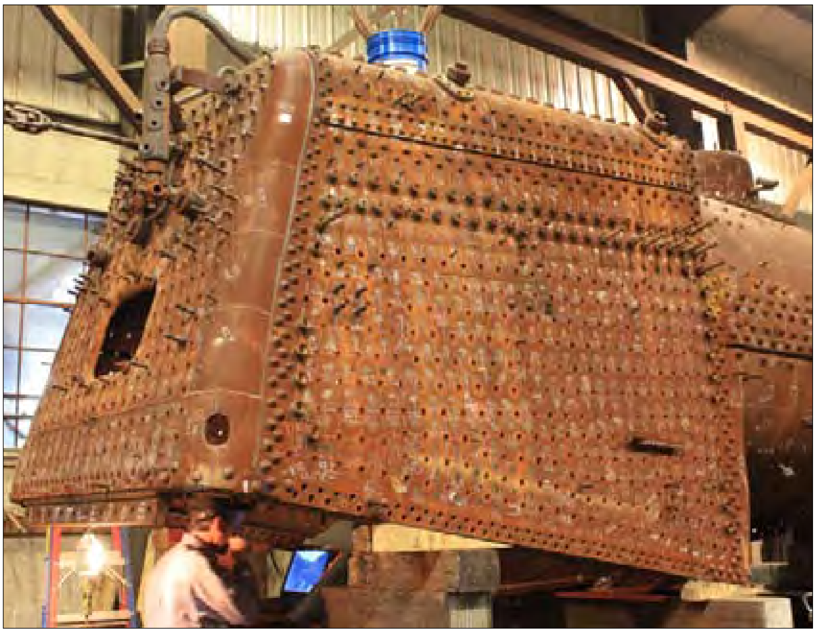
As heritage railway organisations in Australia have very different circumstances, most of this report is a simply that, a report on my findings without many recommendations for changes; hopefully organisations will be able to choose what ideas and information is pertinent or useful to them.

As well, much of what I witnessed and learned during this fellowship had no application for steam locomotives; unless I thought it was particularly interesting or important, I haven't included this information.

REGULATIONS

Australia lags behind Continental Europe, the United Kingdom and the United States of America with mandatory, enforceable regulations for its heritage railway sector. Acceptance of mandatory regulations in the heritage railway sector was very slow in coming in the USA in particular, but a boiler explosion in Gettysburg in 1995 that saw all three crew badly scalded (one with third-degree burns to 85 per cent of his body) finally changed the US perception about the need for regulations, and these were written by a group of professional steam railwaymen and phased in over a number of years.

The committee members continue to meet regularly to discuss any new issues and to discuss changes to the regulations, which continue to be revised and adapted.



During a regulated inspection (mandatory under the US code at 1475 steaming days or 15 years, whichever comes soonest), the Strasburg Railroad commissioned NDT over every square inch of this boiler to determine plate thickness. A workshop staff member is standing inside the firebox, inputting these results onto a spreadsheet on a laptop to use as future reference.

Although operational railways in NSW must understand their responsibilities and prove to the regulator that they are managing the risks of operating heritage rolling stock, there is no comprehensive framework available for operators to follow. Regulators often seem reluctant to assist an organisation with compliance, and rarely exhibit any real understanding of the issues, seemingly only concerned that the paper trail exists and is being followed without commenting whether or not the procedures themselves are appropriate.

This means that although compliance with an organisation’s paperwork is audited, the actual schedules and procedures are not, and so organisations that do not understand—or refuse to recognise—the need for certain maintenance procedures (such as boiler washouts, or fusible plug examinations) and do not put these items into their work schedules are never corrected for their oversights of safety critical maintenance.

Mandatory regulations overseas ensure that these necessary, safety critical maintenance jobs are completed at regular intervals. The regulator’s inspectors often come from a heritage railway background, or have been trained in heritage railway practice, and so are able to discern irregularities or unsafe practices during the auditing processes, rather than simply checking that the paper trail is intact.

This is critical to ensure that heritage railways, which are often operated largely by volunteers with no real engineering or railway background, can continue to operate without causing injury or death, to themselves, other staff and volunteers and the general public.

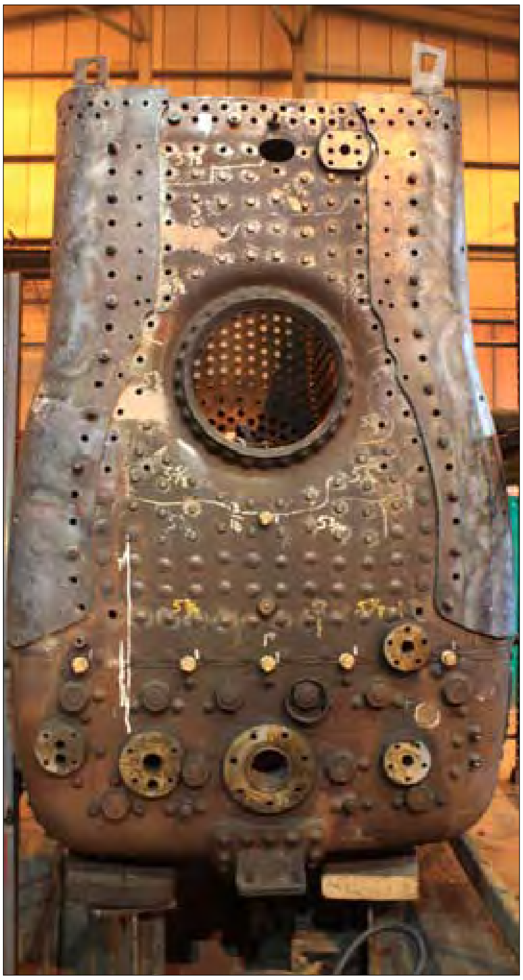
Regulations also provide a safe framework for operators without the necessary background to schedule their safety critical maintenance and give advice for good work practices. An operator, for example, who doesn’t know how to safely fit washout plugs would have this information available to them. The regulators will also know that if operators can prove through their paperwork trail audits that they are complying with (or doing better than) the mandatory regulations, those maintenance schedules and procedures have been written by professionals with a thorough understanding of the issues, regardless of whether or not that organisation has that expertise available on its own staff. Regulations also ensure that every operator is working to the same set of rules, instead of each operator setting their own.

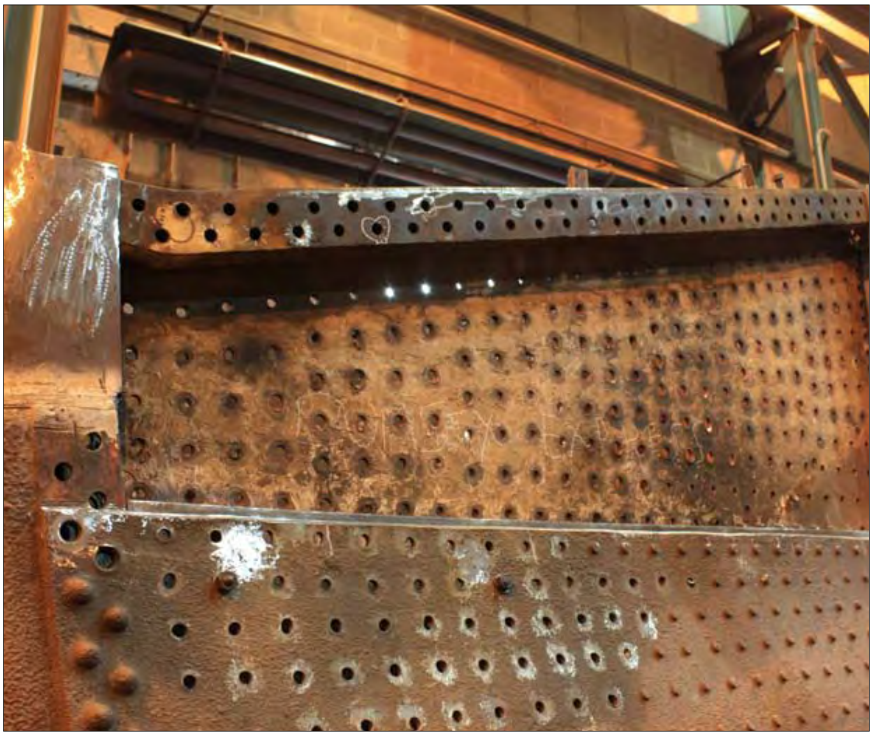
The Rail Industry Safety Standards Bureau (RISSB) in Australia is currently putting together a code of practice for boiler management for all steam locomotive boilers. It is important that Australia has its own set of regulations, rather than blindly copy the regulations in place elsewhere, because operations, water and coal quality and environmental conditions are all unique to each country. As well, differences in the way in which boilers have been constructed make a vast difference to the ways in which they should be maintained and restored.

RECOMMENDATIONS: The regulators should make operators' accreditation subject to their compliance with a national code of practice once it has been written and accepted.

Regulators need to ensure that their auditing inspectors have a practical background in heritage rolling stock maintenance so they understand the regulations and how to apply them to heritage railways.

The committee drafting these regulations should continue to meet to revise the regulations, and should be available to meet with members of railway organisations to consider revisions suggested by operators.





Boilers under repair to regulatory standard in the Severn Valley Railway's workshops at Bridgnorth, including riveting patches on the outer firebox (above) and replacing firebox wall sheet sections (left).

STEAM LOCOMOTIVE MAINTENANCE AND INSPECTION

In the UK, where locomotives may not belong to the company operating them, their pre-run inspections are the responsibility of the operator. Branch-line railways carry out an ‘acceptance’ inspection when a locomotive first comes into their care, and any maintenance issues that are found are raised with the owner before the locomotive is used. Main-line operators are required to do the same to their own locomotives and third-party-owned engines to ensure they are fit for service before venturing onto the main line, although some third-party operators may choose to accept the competence of the locomotive’s maintenance manager. Main-line operators in the US likewise must be able to show that they comply with the standards of the network operator; in the case of the Southern Pacific *Daylight’s* crew, for example, this means they must ensure their locomotive and rolling stock comply with Amtrak’s standards.

Branch-line locomotives at every railway I visited are inspected by the driver each day before entering traffic, and any safety critical faults must be attended to before the locomotive is used, while non-safety critical faults are logged for attention when the locomotive next comes into the workshops for its regular maintenance check. Safety critical items are listed in the regulations (i.e. rules about operating with broken wall stays) so each operator understands their responsibilities and what faults cannot be deferred.

Of course, all maintenance and inspections must be recorded in the appropriate paperwork. Most operating railways have a separate folder for each item of rolling stock, where inspection reports, boiler washouts, and other information is stored. This allows for easy auditing of the operator’s processes, continuity in the procedures and schedules, a clear record of the work that has been carried out, and assists in the scheduling of regular work. (See Appendices B and C for samples of paperwork from Severn Valley Railway and Bluebell Railway).

Full maintenance inspections are carried out by trained mechanical workshop staff and are usually scheduled at the same time as the programmed boiler washouts. Any deferred faults are also scheduled for attention at these times. The periods for washouts are set out in the regulations, and differ between countries; every 28 steaming days in the UK and every 31 steaming days in the US. Of course, local conditions may see washouts occur with greater frequency—the Bluebell Railway, for example, has washouts set at every 14 days for the small locomotives and every 21 days for the larger engines.

Boiler inspections are required every twelve months (as they are in Australia), but in the UK these inspectors are employed by or contracted to the insurance companies, who have a vested interest in ensuring that they understand locomotive boilers. The railway may also have its own contracted inspector, who works alongside the insurance company inspector. As well, the maintenance managers of each railway I visited have a vivid understanding of their responsibilities and liabilities should any accident be caused by their negligence or oversight.

RECOMMENDATION: That the Australian practice of allowing operators and maintenance managers to carry out their own ‘fit for service’ inspections continues, provided mandatory regulations are enforced with audits carried out by regulatory inspectors with the necessary training and background.

That an organisation such as the regulator, ATHRA or the ARA run an information session for boiler inspectors in Australia who may not understand, or may want a refresher, on the fundamentals of heritage steam locomotive boilers, which are often very different from the packaged, water tube boilers that many of these inspectors usually survey.

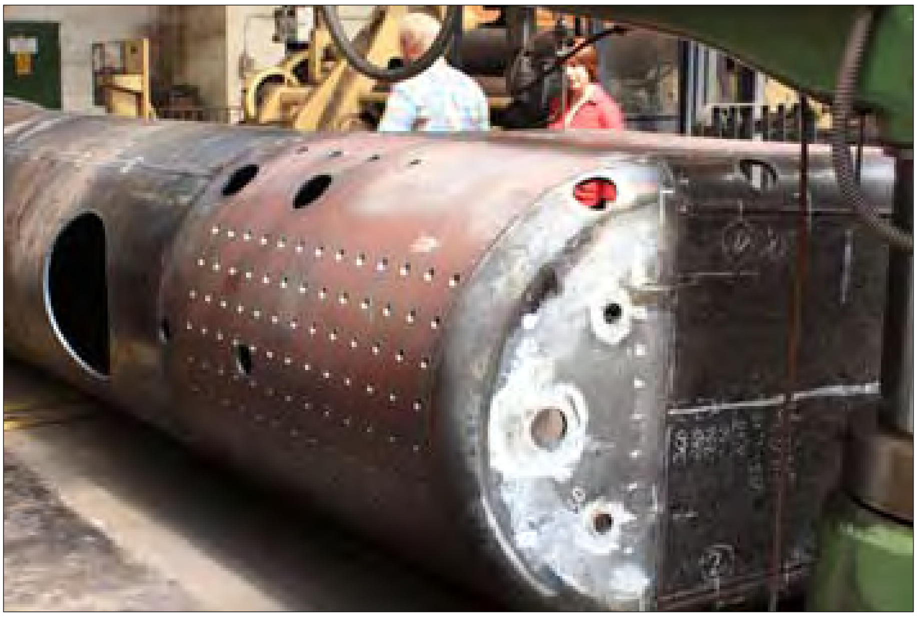
The independent inspector from English, Welsh and Scottish Rail (EWS) examines King Edward I at Bristol Depot the afternoon before an operation on the main line. Only when he was satisfied at its fitness to run was the locomotive permitted on the main line.

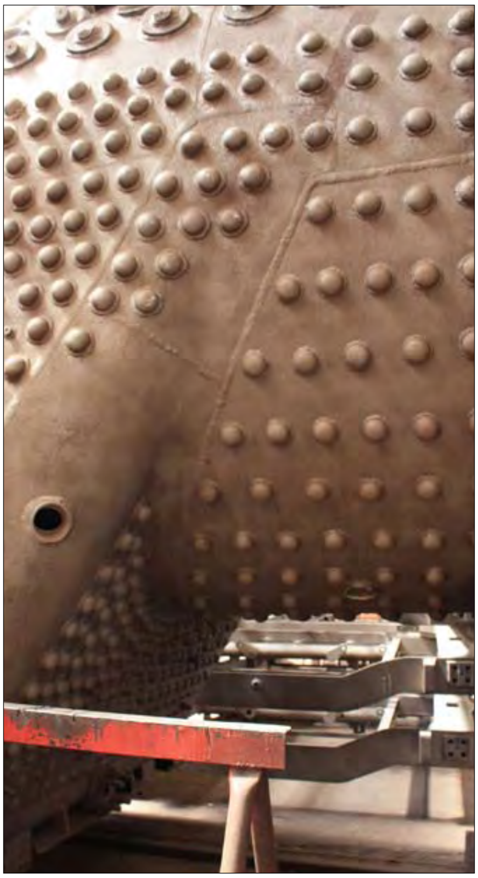
MANUFACTURING AND REPAIR TECHNIQUES

BOILERS: Australia currently has a very limited capacity to manufacture locomotive-style boilers, so this was of particular interest.

Meiningen Dampflokwerk, in Germany, fabricates plate flangings by cutting appropriate standard pressure pipe longitudinally and welding it to the flat firebox plates to create the required shapes. They also purchase standard sizes of pressed flangings, and cut and weld to either enlarge or reduce the plate to suit. The boilers thus constructed are fully welded.

This is a relatively low-cost method of producing boiler components, although it was suggested to me in the UK and in the US that these kinds of fabrications are not as long-lived as pressed flangings. Under European Union regulations, major work is expected to be completed every six–eight years on these boilers anyway.



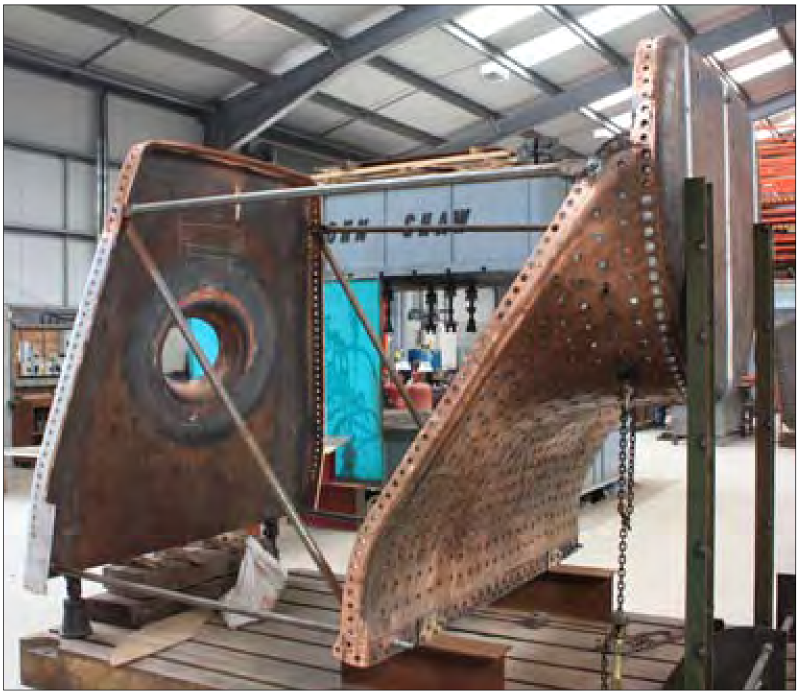


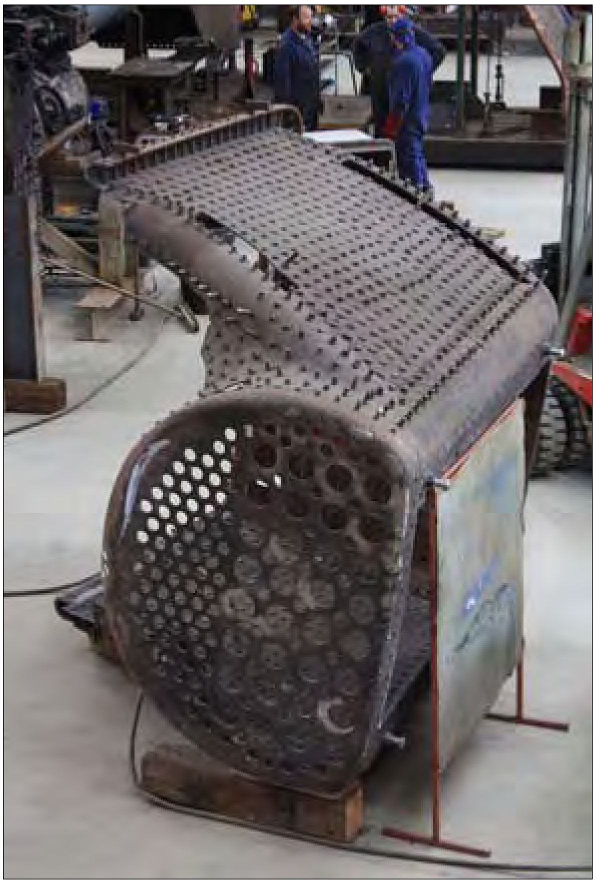
Meiningen Dampflokwerk’s fabrication techniques.
Top: Herr Leifheit explains how they cut and join standard flangings to create the size and shape required.
Above left: Detail of a new-build boiler, showing the welded seams where the section of pressure pipe has been joined to the flat plate, creating the required shape.
Right: Detail of the welded joints to create a throat plate.

Gordon Newton Engineering and R K Pridham Engineering in the United Kingdom are both producing traditional flanged pressings by heating the plates and pressing them over dies. This is a more expensive method of boiler construction, as dies must be manufactured to suit each boiler design. These boilers can be either fully welded or traditionally riveted.

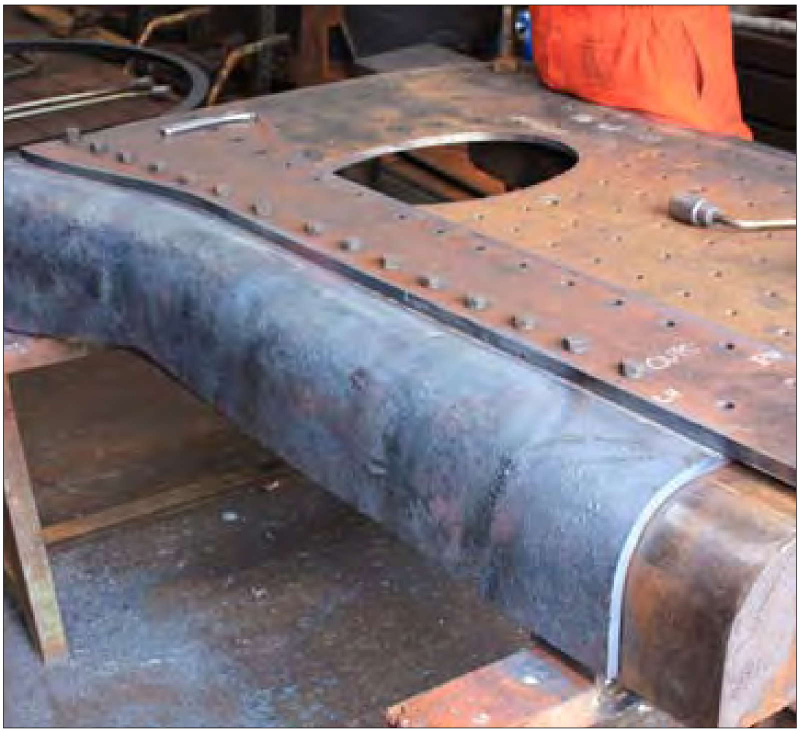
Strasburg Railroad in the United States of America uses a mechanical plate flanging machine that bends the edges of the plates over to form the radii. This machine can only bend a small section of plate at a time, and so the plate must be gradually fed through the machine; a time consuming and painstaking process, although it is less expensive than using a press and dies as the machine can set the radius without the use of a die block.

Many other organisations make up a former, and simply heat the plate and shape it using hand hammers. This can be extremely time-consuming, the finish is not always of the highest standard and often requires a lot of practice to get the former just right. It is, however, the cheapest option for an organisation that has the labour available.





Construction techniques in the UK, clockwise from top left: New copper firebox for *Flying Scotsman* under construction at R K Pridhams; repairs to an existing firebox at R K Pridhams; dies for forming flangings at Gordon Newton Engineering; a small locomotive boiler constructed by Gordon Newton Engineering; a hand-formed corner for boiler repair at Tysley Locomotive Works.



NOTE ON SQUARE-CORNERED FIREBOXES: There has been some debate about constructing fireboxes with square corners i.e. butting the edges of the plates up together and welding them instead of flanging the plates. The advantage of this form of construction is that specialised machinery and processes are not required. The disadvantage (which is substantial) is that locomotive boilers suffer their greatest stressing in these corner areas, and the self-supporting, curved flangings mitigate these stresses by giving the boiler flexibility.

Only one organisation that I spoke to (including railway operators as well as locomotive manufacturers) believes that square corners are an acceptable construction practice. The Chief Engineer of the Ffestiniog Railway said that square corners were put into some of their boilers thirty years ago and, as yet, no real problems have surfaced. However, he qualified this comment by saying that the railway probably would not have chosen to use square corners had they had the option of flanged pressings at the time and that he believes that the narrow firebox boilers on their 2-foot-gauge locomotives operating at the 20 mph maximum allowable on branch lines has probably contributed to the lack of problems. He continued by saying that he would not feel comfortable recommending that any other organisation use this construction method, particularly those with wide fireboxes or operating at main-line speeds.

It was interesting to note that, while the Ffestiniog believes that the size and shape of their square-cornered fireboxes and the speeds that their locomotives operate at probably contributes to the longevity of their square corners, the recent past president of the Traction Engine Association in the UK, Andrew Semple, said that he was yet to see an example of a square-cornered traction engine firebox that did not exhibit major faults.

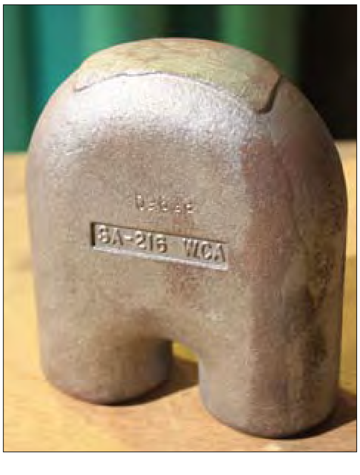
OTHER COMPONENTS: Meiningen Dampflokwerk (MDW) and Strasburg Railroad (SRR) both produce a number of other components for individual sale or for their own contracts or boilers.

MDW manufactures superheater element return ends from pressure pipe, by slicing it longitudinally down the middle, folding the edges over using a die in a press and then welding the two halves back together. The advantage of this is that it is a relatively low-cost operation. Its disadvantage is that the ends are not built up to withstand the hot, eroding gases and unburnt products of combustion that assault them.
SRR has these return ends cast. The advantage is that wall thickness, particularly on the ends, can be easily increased while the disadvantage is the cost of having the casting work done by a contractor.
Other organisations, such as the Southern Pacific *Daylight* crew, advise that they periodically pad weld the outside of their return ends to give them greater protection against erosion.

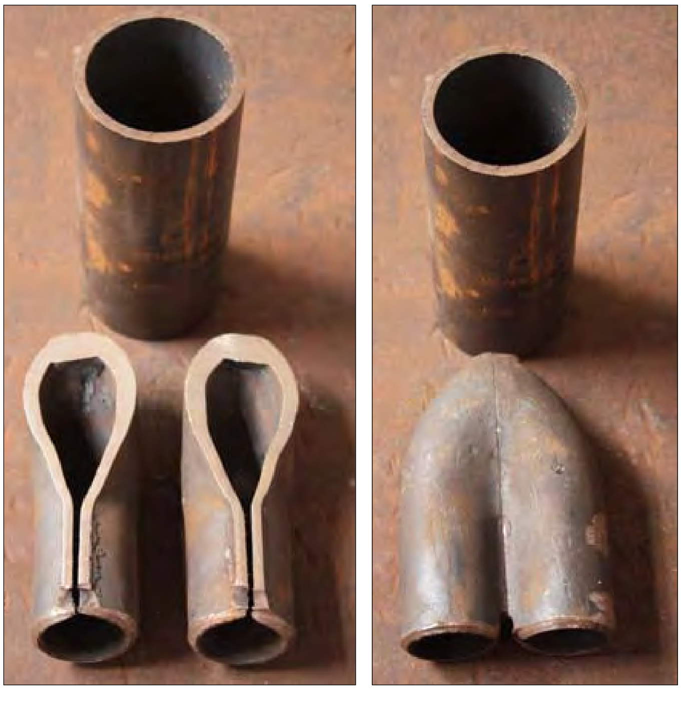
MDW fabricates entire new cylinder and valve blocks, oxy cuts and machines new motion gear and fabricates whole frames. With all the old machinery surviving in their workshops from the steam days they still have the machinery to fit Gibson rings to wheels and machine expansion links without resorting to CNC milling machines; as part of the old East Germany their workshop facilities were not modernised in line with the west. Not only do they still have the machinery to manufacture and repair steam locomotives, they still have the skills to effectively use the equipment.

SRR manufactures new safety valves, turbo generators, washout plugs and injectors for use on their own railway and for contract work. These items are all available for sale, but prospective purchasers in Australia need to be sure that these objects comply with the relevant Australian Standards before purchasing and fitting them.

Above: Partially bent superheater element clip.



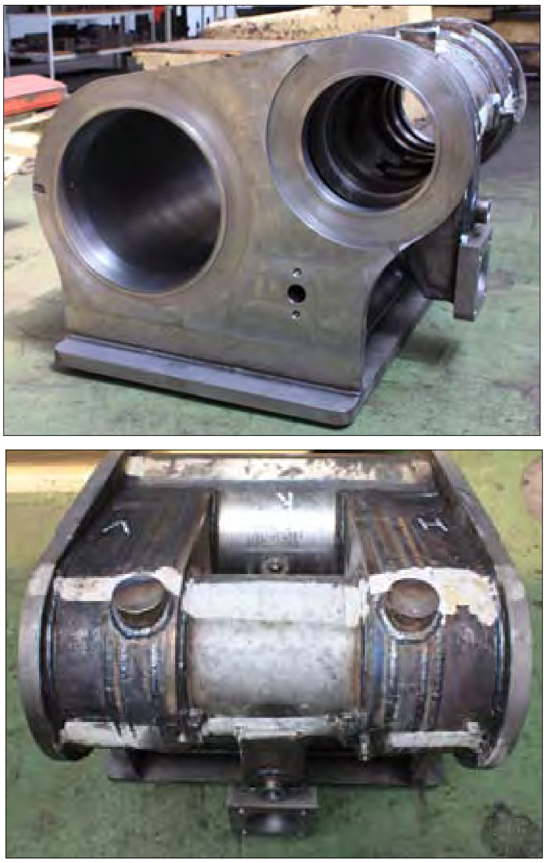
Near right: Cast superheater element return from Strasburg Railroad.



Far right: Meiningen Dampflokwerk's fabricated return ends made from pressure pipe.

Near right: new injector body casting (top) and new injector cone (bottom) at Strasburg Railroad.

Far right: two views of a fabricated cylinder and valve chest at Meiningen Dampflokwerk.



PAINTING: Many organisations in the UK hand-paint their locomotives to obviate the need for spray painting booths. Hand-painted locomotives at Ffestiniog and at Tyseley were streak- and brush-mark free, and with immaculate gloss and shine, to the point I found it hard to believe they hadn't been sprayed. I was advised that the key to this finish is to mix linseed oil with the correct type of paint; Tyseley's manager said they use Tekaloid, available in Britain through John Scanlan at J & L Industrial Paint Services on (44) 19 34820780. He said the amount of linseed oil depends on temperature and humidity and suggested that trial and error is the easiest way to come up with the correct ratio.

TOOLING: R K Pridham's had a huge store of new boiler tools, taps and reamers, and gave me the contact details for their supplier; South Coast Steam Ltd, www.southcoaststeam.com, tel: (44) 1305 821723, a toolmaker who makes their tooling to order. I know the Powerhouse Museum has had trouble finding toolmakers in Sydney with the equipment to deal with the manufacture and sharpening of boiler taps, and imagine that other organisations might have had similar trouble. I included these details here in case anyone has a use for them.

INTER-ORGANISATION SUPPORT NETWORK

Although most organisations are members of umbrella heritage organisations, such as Fedecrail in Europe and the Heritage Railway Association in the UK, the Bluebell Railway's workshop manager is also a member of a smaller informal group of heritage railway maintenance staff in the south of England.

This group meets every two months or so, and its purpose is to provide support and share information among the maintenance staff of the member railways. Through this group, contact details for suppliers can be swapped, tooling can be borrowed and drawings can be copied. It is the perfect vehicle for smaller, younger heritage railways—who are still developing their expertise—to learn processes and procedures and establish their responsibilities under the regulations. The guidance provided by the larger organisations is of benefit to those larger organisations as wel; as all parties are aware, a catastrophic failure at any railway—whether boiler or mechanical—has the potential to affect all heritage railways' operations.

RECOMMENDATION: That heritage railways in NSW (and possibly in Australia) set up a similar, informal group of maintenance managers or workers that meet regularly to allow a sharing of information. This will benefit all parties involved because, although there is already an informal network of maintenance managers in NSW who phone each other for assistance, as the Bluebell's manager explained, sometimes help comes from a source he would not have thought to contact.

WORKSHOP FACILITIES

Most railways operating on branch lines have simply taken over the workshops that were originally built by those railways, and extended or modernised them as required. The California State Railroad Museum's railway workshop building, for example, was Southern Pacific's (now Union Pacific) boiler shop, and contains a drop pit, overhead cranes and a range of donated machinery and equipment.

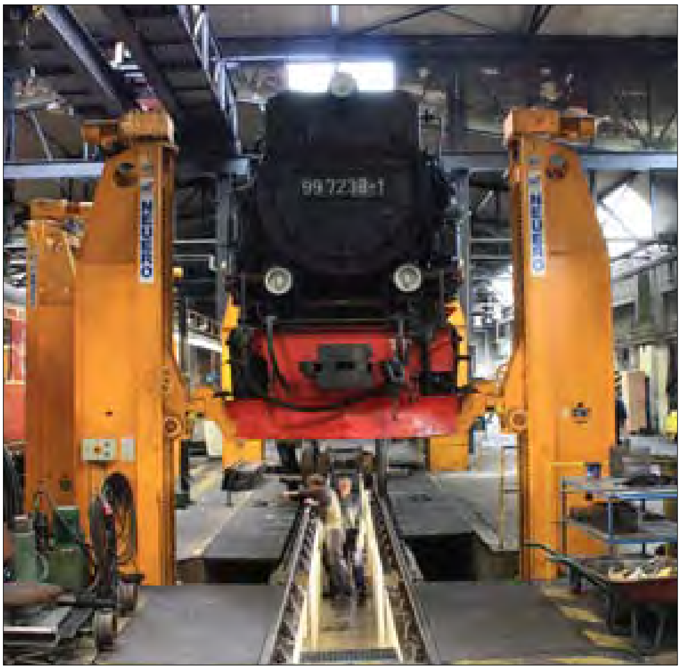
West Somerset Railway has recently moved a shed from Swindon to their yard at Williton, and this now houses reconstruction work, as well as the main locomotive workshops at Minehead.

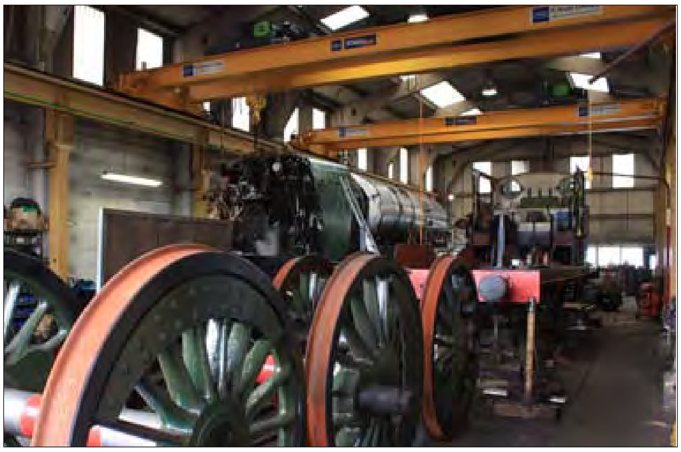
Rigibahn's original locomotive shed at Arth-Goldau is a wooden structure served by a traverser, but their new facility at Vitznau is a spacious and light-filled building fitted with smoke hoods and pits and with enclosed, segregated workshops—including a machine shop, a welding/hot work shop and a carpentary shop—running along the length of the building .

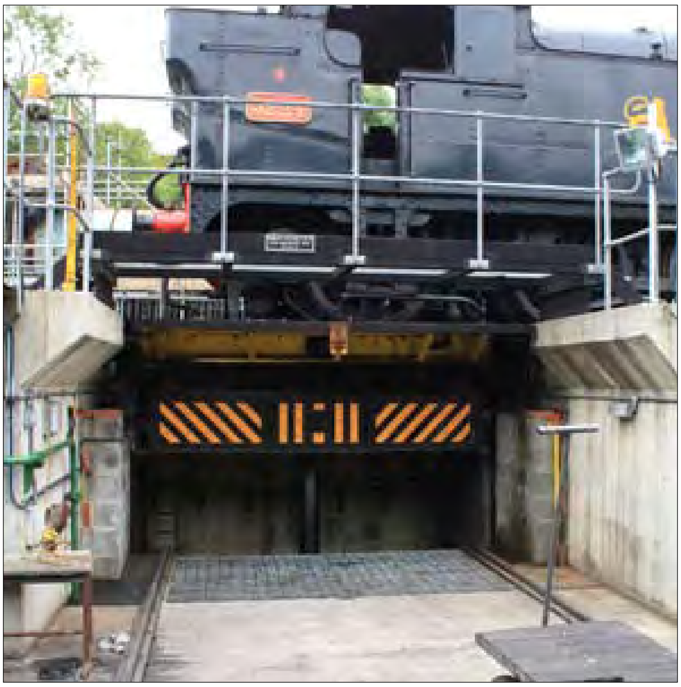
Few operators in the UK have access to running sheds—most lighting up and mid-trip servicing are done in the yards, and there is often too little space in the workshop buildings to house the operational fleet overnight. The North Yorkshire Moors Railway, however, is one that has both a locomotive workshop and a running shed at its Grosmont site.

The owners of itinerant locomotives—locomotives that instead of a fixed home are on hire or contract to other railways or main-line organisations—borrow workshop facilities wherever their locomotives are stabled. The maintenance crew of *King Edward I* have a support coach kitted out with a workshop, as does the crew that operates Southern Pacific *Daylight* 4449.

Of all the operating railways I visited, only three were using roundhouses, and all of these were in the United States. The Durango and Silverton's roundhouse burned down and was rebuilt along with a straight shed in recent years; while the locomotives still operate from and are maintained in the roundhouse, the straight shed provides machine shop and hot work areas with overhead cranes. Unable to have an overhead crane in the roundhouse, drop pits have been fitted, and the roads are long enough that locomotives can be easily disconnected from their tenders. Railtown 1897 State Historic Park (Jamestown, California) also uses a roundhouse, but this organisation's aim is to preserve the entire precinct and use the original (primitive) facilities rather than upgrade to a modern workshop to make operating locomotives easier. The third roundhouse occupants, the group that operates and maintains

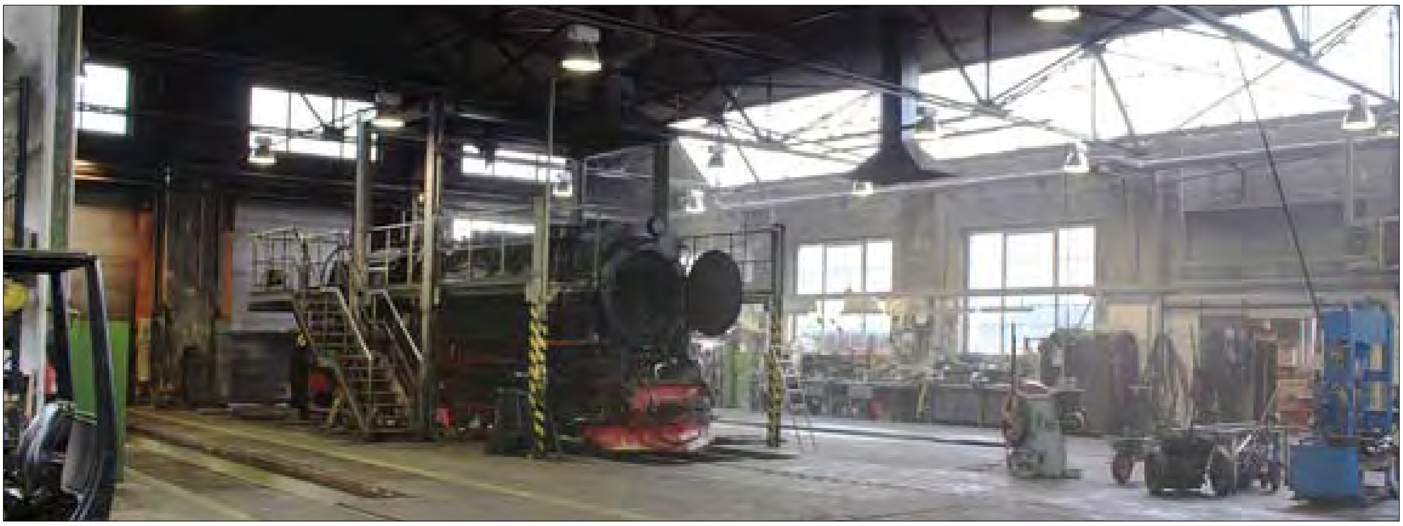


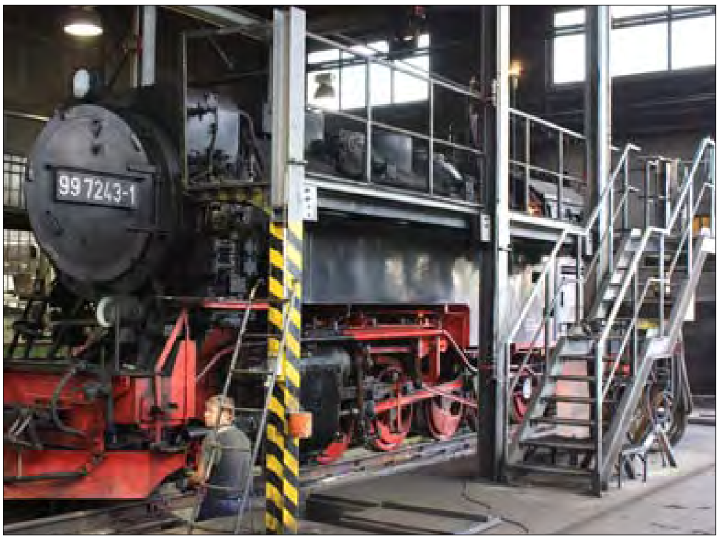




Top: A locomotive on jacks at HSB's Westerntor workshops.
Middle: The overhead cranes in the Bluebell Railway's workshops at Sheffield Park.
Bottom: North Yorkshire Moors Railway's very clever drop pit in the yard at Grosmont uses the lay of the land to facilitate wheel replacement.

WORKSHOP FACILITIES CONT.





Top: HSB's locomotive workshop at Westerntor. Skylights and picture windows provide natural light, concrete floors provide stability and an even working surface and a large work area provides space for major overhauls.

Above left: A raised platform provides a safe work area and access along the sides of the locomotive boiler.

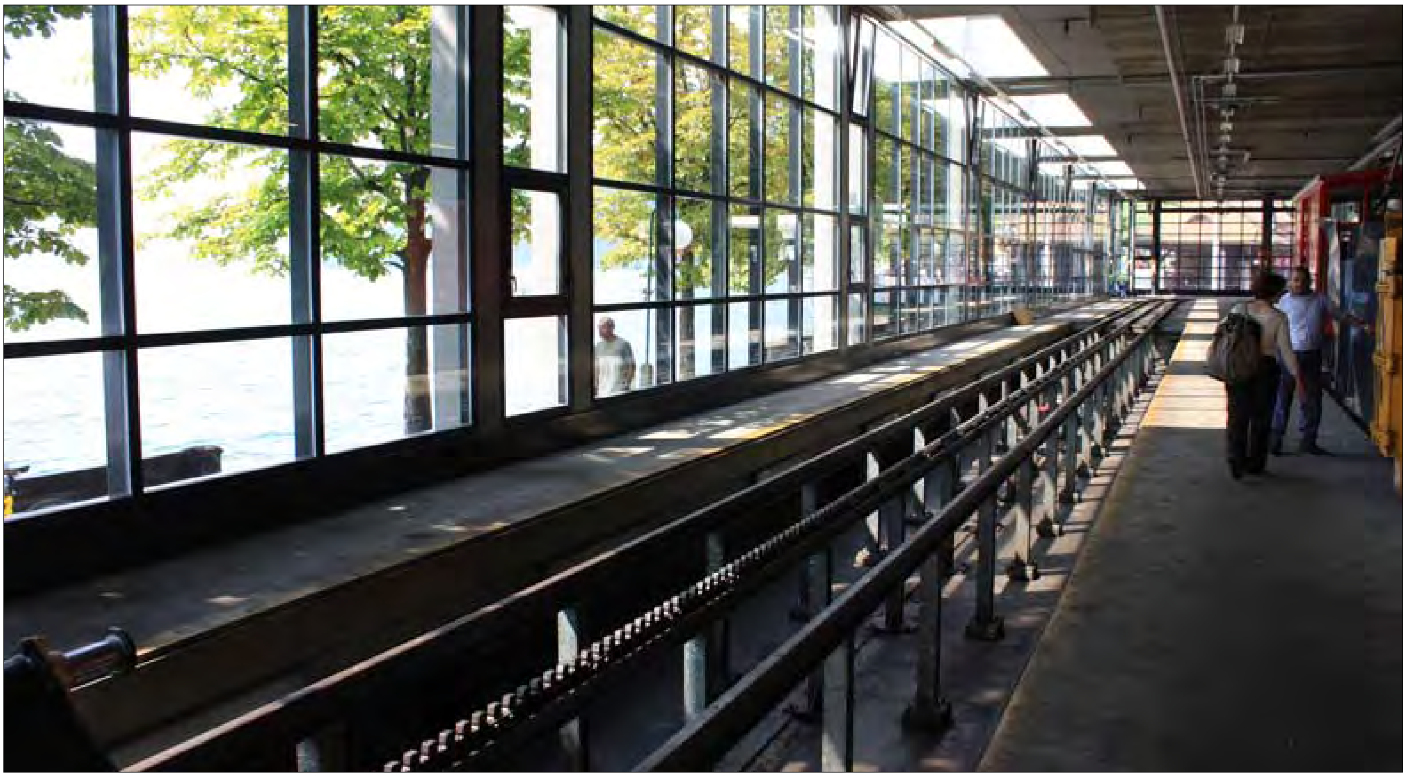
Above right: The separate machine shop at West Somerset Railway is compact but usable, with everything within easy reach.

Southern Pacific *Daylight* 4449, will be vacating their site shortly and moving to a new straight shed that they hope to be able to fit with cranes and drop pits to make servicing and maintenance easier.

All organisations had some sort of lifting apparatus available—whether locomotive jacks, or drop pits or overhead cranes—and some were blessed with a number of options. Wherever possible, machine shops were located separately (although adjacent). Boiler shops also, where possible, were separate, although as boilers are such large objects, this was often more difficult. The advantages of being able to separate the different workshop areas are:

- tooling for each area can be kept separate and tidy
- machine shops and other 'clean' work areas can be kept that way
- less risk of staff engaged in other activities being subjected to bright lights (such as welding flash) or excessive noise (such as riveting or hand-forming plates)
- hot work areas are isolated
- areas such as machine shops and boiler shops that do not require under-locomotive access are free from the potential hazards posed by the pits necessary in mechanical workshops

Carriage workshops were, generally, independent of the mechanical workshops, and a number of organisations, such as Durango & Silverton, had their own paint booths.



Without a doubt the most impressive, modern steam locomotive workshops that I saw on my fellowship, Rigibahn's new workshop and running shed facility at Vitznau is a modern brick/concrete/glass construction. Because of the slope of the land on which it sits, the roof is level with the roadway above, and has been turned into a car park, while the lower level opens onto the turntable, although the shed itself is a straight building, not a roundhouse.

Top: A raised road has been created by dropping the floor level, which allows easy access to motion and bogies. The floor-to-ceiling windows open out onto the public walkway around Vitznau's port, and provide natural light for work while allowing the public to view work in progress.

Middle: The large, sliding doors that separate Rigibahn's running shed from the machine shop. The track extends into the workshop to allow locomotives and rolling stock to be wheeled in for work if necessary. A mezzanine floor inside the workshop holds racking for the neat storage of tooling, materials and equipment, and the floor-to-ceiling windows at the back provide plenty of natural light.

Bottom: The two steam locomotives each have their own position over a pit for servicing and beneath a smoke hood.

ENGLISH SYSTEM OF LOCOMOTIVE HIRE

There are three ways of describing the position of a locomotive within an English branch-line operating fleet:

Owned by the company: the locomotive is owned, overhauled and maintained by the operating company.

Home-based: the locomotive is owned by a third party but permanently based with the operating company, who pays a mileage charge to the owners for its use. Generally the operator is responsible for the day-to-day maintenance and operation of the locomotive and the owner is responsible for the major overhauls—although there are sometimes variations in the agreement between operators and owners. Third-party owners are often volunteer members of the operating organisation, and companies like North Yorkshire Moors Railway often try to roster these members to drive and fire their own locomotives, where appropriate.

There are often strict agreements about the miles that a home-based locomotive will work each year, because the revenue paid to the owner by the operator for the use of the locomotive generally forms the foundation of the money needed for overhauls and seven- or ten-year boiler work. Often the overhaul and boiler work is contracted back to the operator by the third party.

Contract: the locomotive is owned by a third party and leased out for a set amount of money to an operator, who isresponsible for maintenance and repair, while the owner remains responsible for overhaul and seven- or ten-year boiler inspections. These locomotives are sometimes main-line registered engines that have passed the seven-year boiler cycle point, and whose owners choose to send them to a branch line to work the remaining three years left to a branch-line locomotive boiler and raise further funds, although main-line-registered engines still within their main-line lifecycle may also spend time contracted to a branch-line operator—*King Edward I* and *Sir Nigel Gresley* for example, regularly operate both main-line trains and on branch lines.

All incoming locomotives to a railway are subjected to an acceptance examination by the operator, who determines whether the locomotive is fit to run on their line and what work must be done by the owner before the operating railway assumes responsibility for its maintenance and repair. This is, quite naturally, a source of tension between owners and operators.

LIGHTING UP OF LOCOMOTIVES

With many main-line operations, this task is completed the previous day—which allows for a full, fit-for-service inspection—but means that the boiler must be attended throughout the night. Because of the size of the boiler and their determination not to cause stress by forcing it, the Southern Pacific *Daylight* crew's light up procedure begins two days before the trip.

Most branch-line operators that I visited light the locomotives up fresh each morning before use. The locomotives are still warm from the previous day's run, and many of them leave warm coal in the firebox to minimise cooling overnight, and strict rules are in place to prevent forcing of boilers.

Some branch-line operators also leave the locomotives in steam overnight; Cass Scenic Railroad engages in this practice at times, and rosters a hostler overnight to look after the boilers.

Crews at the Cass Scenic Railroad prepare their engine, Shay No. 6, for traffic in the early morning.

STAFFING

Most of the railways and museums I visited had a mixture of paid and volunteer staff, although some, such as the Rigibahn and Strasburg, had only paid staff. I couldn't organise to speak with staff at many of the Continental museums, which means that I am unsure what their ratio is, although I believe that the Deutsche Bahn Museum, at least, has only paid employees.

At organisations whose main business is as a museum—as opposed to operators who have a museum on the side—volunteers generally work 'front of house' as interpreters, guides and educators, while paid staff fill the 'behind the scenes' roles of collection management. Some volunteers do work alongside paid staff in these collection management positions; the California State Railroad Museum staff, for example, have a band of volunteers regularly working in the stores and on locomotive reconstruction and maintenance. Conversely, the National Railway Museum at York chooses not to have volunteers in the workshop where possible, believing that these positions should be filled by paid employees and apprentices learning the craft of steam locomotive maintenance.

Main-line operators tend to have volunteers in their maintenance crews and paid, professional crews on the footplates. This is largely because of the requirements of the main-line regulators regarding footplate staff, and the fact that most operators cannot afford a complete complement of paid staff both on the train and in the workshops.

Operating branch-line railways were split into two distinct groups regarding staff/volunteer mix. All the railways I visited in the UK use volunteers to run the trains—all safeworking positions are filled by volunteers, as are passenger attendants and station staff. Paid staff are generally responsible for all maintenance work on perway and on rolling stock, although sometimes these staff members are assisted or supported by volunteers.

This system has several advantages:

- most volunteers want involvement in train operations, rather than the workshops (i.e. the 'glory' work rather than the 'dirty' work)
- the paid professionals are responsible for ensuring that the rolling stock is fit for service and that safety critical work is properly completed rather than relying on amateurs, who may not necessarily have an appropriate mechanical background
- the enthusiasm of volunteers is an asset that should be at the forefront of the visitor experience

The paid workshop staff in most of these organisations are expected to gain safeworking qualifications and keep them current to enable them to perform these duties on days when no volunteers are available.

Most Continental European railways that I visited (Harzschmalspurbahn, Rigibahn and Brienz-Rothorn) and those in the United States (Cass Scenic Railroad, Strasburg Railroad, Durango & Silverton) use paid employees in all positions, although Cass did have a small group of volunteers working on a reconstruction project in the workshops (rebuilding a Climax). This assures seven-day rostering, unlike organisations that rely on the availability of their volunteer workforce.

A problem with paid staffing positions, of course, is the ability of these organisations to pay a decent living wage commensurate with the skills sets that these tradespeople bring with them. Heritage railways are often staffed by people who work for less money than they could on the open market simply because they have the passion and commitment to heritage, a loyalty to that organisation and their living situation (a spouse with a higher-paying job, for example) allows them this luxury. Of course, this means that heritage organisations often cannot take advantage of skills and abilities in the market place that would greatly benefit them, simply because the prospective employee cannot afford to work for less than market rates.

There is no easy answer to this problem. Many US heritage railways are run by the government, under the umbrella of State Parks, which contributes funding each year to keep them operational. However, this often brings its own disadvantages: employees of one such organisation told me that any extra money their railroad earns goes into other, less successful organisations (and not necessarily heritage rail) and so there is no incentive to become more successful and earn more money.

The California State Railroad Museum is a State Park-run institution, and its foundation (see separate entry under 'Funding') funds a certain number of paid staff positions each year to take up the shortfall. This means that any given project may have a mixture of State Parks, foundation and volunteer staff.

It was also interesting to note that all organisations who had a proper restaurant, bar or buffet paid their kitchen and wait staff. This is probably because these positions require a high level of training, such as food handling and preparation, kitchen management and hygiene, and liquor licensing certificates, as well as the fact that most of their menus included chef-prepared dishes. Many people working in the food industry are already rostered for split shifts, weekends, lunches and evenings, and are unable to put time in to volunteer their skills. It is also probable that if they do have the opportunity to volunteer their skills to the community, they are far more likely to offer them to charity based soup kitchens and the like. Finally, as these buffets and restaurants are responsible for a large amount of the profit made by the organisation each day, the standard must be of professional quality to ensure that customers are satisfied with the meal and service and that they return. For example, the Welsh Highlands Railway (Porthmadog) admitted that they had tried to run their cafe using volunteers, but that it had not been successful. Their cafe has been leased out to a company that employs professional kitchen staff, and it now turns a profit.

Left: 3440, *City of Truro*, sits on the disposal pit at Bewdley on the SVR at the end of the day's operations, while the volunteer staff rake out the ashes.

Below left: the paid fireman on the HSB's first train of the day oils around in the yard at Wernigerode.

Below right: the volunteer fireman of 3850 prepares the fire while the driver completes the mechanical checks.

ROSTERING

PAID: This obviously happens in accordance with that country’s employment laws. I did find a few interesting things to note, however.

Harzschmalspurbahn only operates steam locomotives to Brocken for nine months each year; the railway closes down over winter. During the operating season, the operational staff are paid an eight-hour day to do twelve hours of work, and then are laid off on full pay for the three months that they are not required.

Each locomotive at Cass Scenic Railroad has its own regular driver and fireman rostered to it; no other crew is ever rostered to that locomotive unless covering for illness or leave. When the locomotives come into the workshops for their regular washouts and mechanical inspections, the footplate crew accompany it, and assist the workshop staff with the work. The benefits of this system are:

- each crew understands their particular locomotive
- because each crew is responsible for their own locomotive, they take particular care to ensure that it is operated responsibly
- minor maintenance work is attended to immediately, and not put off because ‘some other crew can do that job tomorrow’
- involvement in the workshop procedures gives each driver and firemen an understanding of the mechanical and boiler requirements, and helps engender respect for the engine and for the workshop staff

The disadvantage of this system, as pointed out by the workshop manager of a different railroad in the US, is that some drivers and firemen are exceptional enginemen, but not necessarily capable in the workshop (and the converse is true of the workshop staff). He suggested that while he would love to institute a similar system himself, it would probably be a disaster with his particular staff. I personally, however, believe that the increase in understanding and respect between the enginemen and the workshop staff is probably worth the investment in time.

Volunteer enginemen at the Talyllyn Railway in Wales also advised that they are expected, when possible, to put time in at the workshops over the winter break to help the staff there with the regular, annual maintenance and in preparing each locomotive for the coming season’s operations.

At all railways where volunteer crews operate the trains, the paid staff must have road knowledge, safeworking and operational qualifications to cover any rostered shifts that volunteers are unable to fill, or cannot fill unexpectedly. In order to keep their qualifications up to date, therefore, paid staff must be rostered on the trains on a regular basis.

VOLUNTEER: Like paid staff, operational and safeworking volunteers are bound by restrictions and regulations on their working hours. All railways that have volunteer operational staff set a minimum number of days each year that a volunteer must work to remain active, and is generally about ten days per year. This is particularly important for safeworking staff, who must keep their qualifications current.

Some volunteers, obviously, give far more than the minimum. These are usually retired or semi-retired people who live in the area and can afford to give one or two days each week to the organisation. Those staff still in full-time employment and/or those with young families often find the requirements a little more onerous, and a number of organisations, such as Severn Valley Railway, try to suggest to these volunteers that perhaps they could be involved in some area of the railway that doesn’t demand so much participation.

Some volunteer staff divide their days over an entire year (i.e. they might be available one day per month), while others use their annual leave and give their minimum days in a single block. Railways that offer this kind of volunteer service often make provision for accommodation for these volunteers; Severn Valley, West Somerset and Ffestiniog Railways, for example, provide sleeping compartment carriages done up as crew vans or share cottages to stay in.

DIVISION OF RESPONSIBILITIES

On main-line operations, it is generally the responsibility of the volunteer maintenance team to prepare the locomotive for service, complete mid-trip servicing and put the locomotive ‘to bed’ at the end of the day. As in NSW, these locomotives are often put into steam the previous day to allow enough time for the inspection and the rectification of any minor issues. This means the locomotive boiler must be attended throughout the night.

At all the operating branch-line railways, it is the incoming driver and fireman’s responsibility to light up and clean their locomotive before use, and their job to ‘dispose’ the locomotive (drop the fire, clean the grate and the smokebox, refill with coal and water) at the end of the operation. Because these locomotives are generally still warm from the previous day’s operations, the driver and fireman’s shifts begin somewhere between two and three hours before their first train is due out, to give them enough time to light up, clean, oil around and do the daily mechanical and boiler examination. The advantage of this is that the crew have the opportunity to set their own fire and are responsible for the engine’s cleanliness and its fitness for service. During peak season on some railways, however, with long operating hours, it is not always possible for a single crew to run all a locomotive’s trips for the day, and a second crew is brought in for the second half. This is apparently unpopular, particularly with the second crew, who must shape an existing fire and are left to dispose the engine.

One of the driver’s responsibilities is the daily mechanical inspection of his locomotive (and train, although on some railways the mechanical inspection of the train is the guard’s responsibility) and the logging of any faults through a daily log sheet (see Appendix C, sample of Bluebell Railway driver’s daily card). Although drivers are expected to attend to some of these items themselves, such as taking up the brakes, a number of workshop managers expressed dissatisfaction with the way this task is often carried out by the footplate crews, and said that they are either considering sending a workshop fitter out to do this job, or investigating the possibility of better training for their drivers in this area. Another workshop manager explained that one locomotive had been removed from service a number of weeks before it was scheduled into the workshops because a well-meaning driver had over-tightened the little end and the motion now had to be repaired.

From these anecdotes, it is plain that a clear delineation of tasks is necessary, and that good training is also essential for the non-safeworking tasks.

The driver and fireman of *Sir Nigel Gresley* dispose the locomotive at the end of its day’s operations at the North Yorkshire Moors Railway’s servicing facilities at Grosmont. The locomotive has been recoaled using the coal loader, and the tender filled with water. The fire has been cleaned and the fireman has opened the lagging ‘door’ and the smokebox door and is busy shovelling ash from the smokebox into the waiting scoop of a front-end loader.

VOLUNTEER PROGRAMS AND CO-ORDINATION

The organisations with the best volunteer programs had one or two people filling the role of co-ordinator/s, whose entire responsibility it is:

- to recruit and welcome new volunteers
- to fit volunteers to appropriate roles
- to compassionately assist volunteers to move to other roles if they are not suited/no longer suited to the roles that they have been filling
- to organise training
- to keep records
- to maintain contact between the organisation and the volunteers (regular newsletters, sympathy/get well cards etc)
- to arrange volunteer activities (such as inductions, Christmas functions etc)
- to liaise between volunteers and staff where necessary
- to resolve conflict between parties (either volunteer–volunteer or volunteer–staff)
- to apply the disciplinary code for misconduct.

In organisations where volunteers are such a necessary resource, the importance of this role is such that it really should be filled by one or two full-time paid staff, who take responsibility for the overall ‘health’ of the volunteer program. However, it is often the case that organisations cannot afford the services of a paid co-ordinator, and rely on volunteers to fill these roles themselves. It is also important that a volunteer co-ordinator be available on site every day that volunteers are. For seven-day-per-week operations, of course, this means that more than one co-ordinator is necessary to cover all days.

Although many other railways had a number of similar elements, the Severn Valley Railway’s program was particularly noteworthy. The two co-ordinators (themselves volunteers) organise a special induction day twice per year to introduce prospective new volunteers to the railway. A special train is rostered for the day and the new volunteers ride on this and visit each area of the railway and meet the staff responsible for each division during the day. They are allowed time to speak to each division supervisor on a one-to-one basis and ask questions to determine what area of the railway they would like to work in.

Every new volunteer is given a package that contains:

- a personalised letter of welcome
- volunteers’ handbook
- a booklet containing a brief history of the railway, its route and a description of the kinds of jobs that volunteers can be involved in
- the SVR policy towards young people
- SVR health and safety policy
- code of conduct and disciplinary procedures for volunteer staff
- a short introductory DVD about the railway
- all the brochures and papers that are available to the general public

With help from the volunteer co-ordinators, new volunteers choose the area they would like to be involved in and are assigned to that divisional supervisor (a paid position). These divisions and jobs are generally divided into ‘operational’ and ‘non-operational’ roles. After assigning volunteers to an area, it is the co-ordinator’s job to follow up with each volunteer and their supervisor a month later to ensure that all is going well, and deal with any problems that may have arisen during that time.

Operational roles include ‘motive power depot’(drivers, firemen, locomotive cleaners), guards, ticket inspectors, signallers and the permanent way workers, and a medical examination is required for the motive power depot, guards and signallers positions, which the railway’s doctor conducts at regular intervals. Volunteers in these departments must retire at 70, although can then move on to another area within the railway, should they so wish.

The non-operational area covers all other roles (such as station staff, museum staff, buffet attendants etc), and are not classified as medically critical, although a number of them do require a colour test to ensure that signals and flags can be differentiated.

Training is provided for all voluntary positions, particularly for safeworking positions. Footplate crews, for example, usually spend the first twelve to eighteen months cleaning engines before they can complete the fire-lighting course and the firing course, and generally work on the railway for three to four years before they are passed out as firemen. Training for the signallers is around twelve months; six months of tutorials and bookwork (one day per fortnight) and six months practical training on the railway itself. There is a two-year waiting list for this course.

Volunteers, particularly those who deal with the general public (such as station staff and carriage attendants), must wear the prescribed, three-piece uniform. The railway provides half the money towards the cost of all volunteer clothing, including overalls and safety boots and vests for maintenance workers as well as the company uniform.

A number of organisations, such as SVR and Bluebell, also have programs for younger members, but it is the Talyllyn that particularly shone in this field.

The Talyllyn Railway, although the first preserved railway in the world (not to be confused with Bluebell, which was the first standard-gauge preserved railway), is not as well-known as its Welsh Highlands cousin, the Ffestiniog, nor as accessible. With many members coming from all over the UK to volunteer, and often during annual leave and work holidays, the railway has focused on a family-friendly approach to encourage their younger volunteers to continue volunteering once they have families of their own and work commitments to meet.

Their young people's program is designed to ensure that parents who wish to volunteer on the railway can bring their children along, and know that the children are safe.

Children from five to twelve can join the Tracksiders Club, where they work for the railway under adult supervision and away from the dangers of the running lines. Among the projects that the Tracksiders have been responsible for is the design and construction of a children's playground at the station at Abergynolwyn. Children in the twelve to fourteen age bracket join the Navvies Club, where they take on more responsibility for railway work (such as building retaining walls) but are still not involved in operations. At the age of fourteen, children can sign on as an engine cleaner, where they are taught the basics of steam locomotive operations, and from sixteen can begin to learn to fire and drive. The driver and fireman working Talyllyn on the day that I visited were 35 and 24 respectively, and—to my surprise—gave me the best show of enginemanship I had witnessed for a long time, largely because they had both grown up around the railway and had a fine appreciation and respect for the locomotive, which they treated very much as an historic object, rather than a commercial tool.

These kinds of children's groups help to 'grow' new volunteers for a railway in a safe and supportive environment, and once the children are old enough to join as fully-fledged volunteers in their own rights, the organisation can be confident that they understand that organisation's ethics.

TRAINING AND SKILLS TRANSFER

Just as in Australia, many heritage railway organisations overseas find it difficult to recruit appropriately qualified staff for steam locomotive maintenance, refurbishment and operation; as these specialist skills disappear in general, people who have them are no longer readily available on the open market.
This means that most heritage railways must train their own staff and volunteers in order to ensure that the skills base is available to them.

WORKSHOPS (PAID STAFF): This usually occurs through apprenticeships, and allows the existing tradespeople within the workshops to transfer the necessary, specialist skills onto the next generation. Passed tradespeople from other areas can be employed and trained in steam locomotive maintenance—the North Yorkshire Moors Railway gets many of its boilermaking staff from the petro-chemical industry for example. This is obviously less time consuming than training an apprentice from scratch.

There are a couple of advantages of organisations training their own staff:

- there are often a number of ways to achieve the same end with steam locomotive work, and this kind of training ensures that all staff are using the same techniques and methods
- because many of the skills necessary to refurbish or maintain a steam locomotive are particular to heritage railways, these are not skills that are taught at technical colleges, and therefore the training of apprentices within the heritage railway organisations means that the skills are in fact being passed on.
- steam locomotives are complex pieces of machinery, and when in normal, general service, the railway companies hired specialists for each area—there were fitters who specialised in the air brake system, fitters who specialised in plain bearings, machinists who specialised in piston rings and others who specialised in valve seats, boiler makers who concentrated on setting plates, and others whose skill was in riveting. Nowadays, heritage operators can not afford all these specialists, and tradespeople are expected to be specialists in all the fields instead of one.

There are, however also a number of disadvantages:

- because of the lack of funding and skills, the staff of heritage rail operators are often stretched thin—too much work, too few people to do it—and organisations often cannot justify the extra expense and the four years to train a new person. Contrary to a common belief, apprentices are not an extra pair of hands, but generally divert a qualified tradesperson from his own job to oversee and teach.
- because heritage rail organisations cannot afford to pay market wages, they often find it hard to keep their apprentices once training has been completed and their apprentices become fully fledged tradespeople

With few of these skills being taught in training colleges and via general apprenticeships (as opposed to an apprenticeship within a heritage railway organisation), and with the slow disappearance of the skills from the general market, it has been difficult for organisations to learn new skills if they weren't contained in 'corporate' memory.

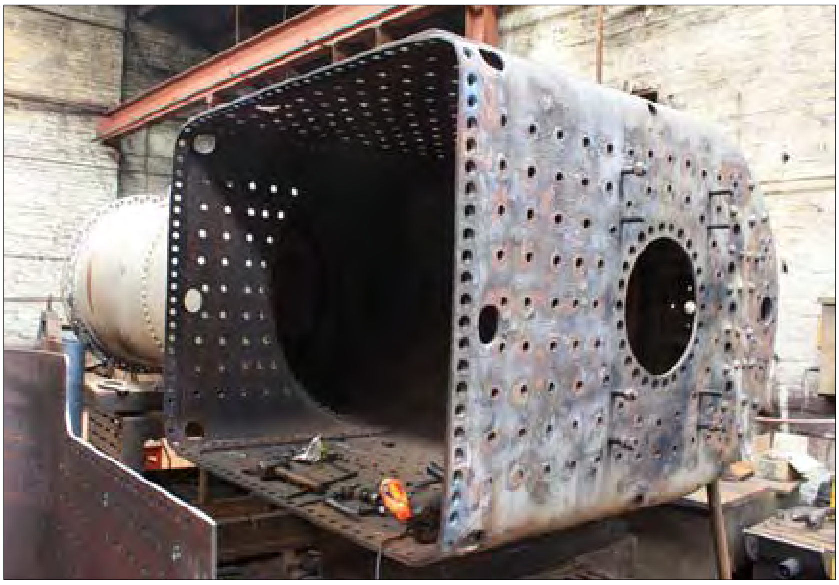
The Boiler Engineering Skills Training Trust (BESTT) is starting up a new training organisation to teach specific locomotive boiler manufacturing skills in Bradford in the UK. This organisation aims to make the learning of these skills accessible to all interested people by running intensive courses in skills such as setting plates; rolling, bending and pressing plates; and hot riveting. The hope is that railways in the UK (and across the world) who can identify a need for these skills within their own organisation will send staff or volunteers to this new school, and that these students will be able to take these skills back to their own groups and even, perhaps, pass some on to others. In this way, BESTT aims to keep the very necessary and endangered boilermaking skills alive and help heritage railway organisations safely and effectively carry out their own repairs.

The Heritage Lottery Fund (HLF) distributes a share of the income derived from the National Lotteries to a range of heritage-based projects, including training bursary schemes (for the other HLF heritage projects, see the section under ‘Funding’). These schemes provide specialist training placements at heritage sites, and provide mentoring, training and assessment from skilled heritage professionals.

The aims for the scheme are to:

- improve the quality of skills available to the heritage sector by providing new entrants or existing staff with work-based training opportunities
- develop innovative, exemplar training schemes which promote diversity in the workforce
- enable heritage organisations to work in partnership with other agencies
- disseminate good practice.

This type of scheme will be useful to assist potential students fund their studies with BESTT, and would be a valuable program for the heritage sector in Australia, particular for the heritage railway sector, where access to overseas training may become necessary if we are unable to effect proper skills transfer in the fast disappearing skills in boilermaking and steam locomotive mechanical maintenance.



BESTT’s new training centre and scheme will teach heritage railway organisations how to repair existing boilers (as above) and how to form, roll and set plates for new constructions (right) and rivet them together.

RECOMMENDATION: A similar training organisation in Australia that also covered fitting skills and mechanical maintenance would be of immense benefit to heritage railway operators and museums and invaluable in transfer of these fragile skills. In the short term, until such an organisation is set up and fully functioning, a scheme to fund traineeships to send workshop-based employees and/or volunteers to BESTT’s facility when it is running in Bradford would be beneficial to groups in Australia that are struggling with a lack of skills in these areas. This funding scheme could also be used to visit other organisations in Australia who still have these skills and are willing/capable of training a new generation.

WORKSHOPS (VOLUNTEERS): Many of the volunteers who work in heritage railway workshops overseas do so because they already have the necessary skills i.e. many are retired tradesmen, and some were even railway tradesmen who did these very same jobs for a living.

There are, however, a few unskilled workers who volunteer for workshops duties. Some of these come in regularly to clean the floors and the machines and generally do the jobs traditionally given to ‘labourers’ and so free the tradespeople up to concentrate on the jobs that require the trades skills.

Others, who show the inclination and promise, are trained on certain machines or for certain jobs. The Bluebell Railway, for example, trains workshop volunteers in a range of trades skills. A list on the workshop wall shows which volunteers are qualified or competent to use which items of equipment.

OPERATIONS (STAFF AND VOLUNTEERS): All safeworking crews must be qualified for the network rules and procedures for the railway they are operating on. Main-line crews must be trained by an organisation accredited to teach main-line regulations, and, (as in Australia) these are usually external training companies.

Railways with branch-line operations, however, are generally able to train their own staff and volunteers to operate on their lines. For footplate crews, this training comes as part of the package of learning to be an engineman.

Every organisation I spoke with uses the ‘traditional’ method of bringing on an engineman, whether paid staff or volunteer. New footplate recruits begin as engine cleaners, and learn the names, position and functions of all the locomotive components and basic safety. Once deemed competent as an engine cleaner, they may apply to become a fireman, where they must complete theory (which may be presented as a series of classes or tutorials, or simply give as a book for home learning) and pass written exams. At the same time, they receive practical tuition on the footplate, learning the craft of firing a steam locomotive.

Once they have passed the practical and written examinations that allow them to become fully fledged firemen, they may begin on the driver’s course, which again includes a tutorial and a practical element and deals with steam locomotive management. It might take many years, particularly for volunteer footplate crew, to rise from the starting position of engine cleaner to a passed driver, and some volunteers never manage the progression through the ranks, due to work and family commitments elsewhere. Throughout all three of these levels, students are taught the safeworking rules of the railway and are learning the road through practical experience.

Many organisations conduct regular refresher courses to ensure that their crews are not becoming forgetful or lazy, and changes to rules must be advised to all operational staff in a controlled manner (i.e. staff must sign to say they have received the updates, which leaves a paper trail to ensure that all operational staff have in fact been advised of changes).

All staff and volunteers engaged in safeworking duties on branch-line railways (such as guards, conductors, stationmasters, signallers, perway engineers) must complete various training modules to ensure that they have the skills and abilities necessary to run a railway, and some courses are so popular that the waiting list for entry can be years long; the Severn Valley Railway’s signalling course for volunteers, for example, has a two-year waiting list to enrol. In these cases, the railway finds those volunteers other appropriate voluntary work to engage in to keep them actively involved while they wait.

Most railways try to run training courses for their non-operational volunteers as well, to ensure that they are performing to a standard that the railway is happy with, and to help give their volunteers a feeling of personal achievement and success.

Talyllyn’s fireman began working with the railway as part of the young volunteers’ groups. The driver, only in his middle thirties, had been involved for nearly thirty years. Between them, they treated me to one of the best displays of enginemanship I have ever witnessed.

A NEW DIRECTION

Like most heritage railway groups and railway museums in Australia, many overseas organisations were started by groups of enthusiastic volunteers, who bought, begged and borrowed rolling stock and objects as they were being deaccessioned from regular service, and who scrimped and sacrificed to find accommodation for their collections, broke their backs to repair track and rolling stock, and began running trains.

The museums were set up as dusty lines of locomotives and carriages, sometimes undercover but often not, with limited (if any) interpretation and no proper conservation management plans or collection policies. These museums were only really of interest to other rail enthusiasts, who delighted in walking up and down lines of broken-down old engines, whether for reminiscence or study, or simply for the sheer joy of seeing a steam locomotive up close.

The operations were largely run for the benefit of rail enthusiasts, particularly the long, main-line tours, with a lack of regard for comfort or education, and a focus on going further and faster and making the locomotives work harder each trip. Among many in the field, it is considered that accommodating those without a passionate interest in the subject is ‘dumbing’ the experience down rather than making it accessible to all, which meant that the tours and the museums had little relevance to those people not passionate about railways.

Things have changed. Rail enthusiasts—particularly steam train enthusiasts—are a dying breed. Nostalgia can only truly be felt by someone who has experienced an event earlier in their lives, and trains and railways are no longer within many people’s fields of experience. Many children today have no experience of riding on a train, and their parents (and in some cases their grandparents) never rode on a steam-hauled train. In order to save themselves from extinction, rail preservation organisations and museums must re-invent themselves to engage and enthuse a new generation of customers.

This is what successful railway operators and museums overseas have accomplished.

Operators generally choose to run short, branch-line trips instead of long, main-line tours. Museums use a range of interactives and interpretive displays rather than the long lines of dusty locomotives that were once the norm. The shops sell a range of merchandise to cater for all budgets and tastes. By doing this, the operators and museums have managed to excite the imaginations of a new generation of customers from a range of backgrounds and interests, making new converts to the field of rail preservation, and no longer needing to rely on the rapidly diminishing bands of die-hard rail enthusiasts for income.

Below: A mix of people admiring the railway exhibits at Cité du Train in Mulhouse, France.

OPERATING PHILOSOPHIES: HERITAGE AND TOURIST RAILWAYS

A philosophy details how a railway will operate (or do business) and what it is trying to achieve. It's important that everyone involved knows and understands the philosophy so that everyone works together towards the same goals. Developed to suit the circumstances of each organisation, no two philosophies are precisely the same, nor can it be said that any one operating philosophy be made to fit all organisations For example, is the organisation there to educate about history, instruct about the workings of railways, or is it keeping something more ephemeral alive, such as preserving the spirit of the railways?

Although all organisations, to some extent, have a philosophy, some of these are implicit rather than written into their charter or their mission statement. The official capturing of the philosophy is important for all organisations, as this forms the basis for making decisions about the operation and the operating fleet.

Many of the philosophies that I observed in action seem to depend on the age and type of the rolling stock available. Organisations with very old locomotives, such as the Talyllyn Railway, operate their rolling stock carefully and treat them with a respect usually reserved for museum objects. Railways with much younger locomotives—most of the Harzschmalspurbahn locomotives are nearly 100 years younger than the Talyllyn's for example—tend to use their locomotives as commercial tools rather than museum pieces.

As each organisation's philosophy is unique, it is difficult to categorise them, but I have listed some of the more obvious operating philosophies into broad groups as examples.

COMMERCIAL OPERATION: There to make money ...
These railways are more truly tourist railways than heritage railways.

The Brienz-Rothorn Railway was one such operation and although repeated requests for meetings with workshop and operational staff went unanswered, I still visited and was able to observe its philosophy and operation as a tourist, rather than a guest. It runs trains from Lake Brienz to the top of the Rothorn Mountain on an hourly schedule, seven days per week. It is run completely by paid staff and its usual, operational steam fleet comprises new-build locomotives designed for single-man operation, while the carriages have been specially designed and built with plexiglas roofs to maximise the views.

Contact between the staff and the customers is discouraged. Intending passengers are unable to access the platform until the train has pulled in, disgorged its passengers and they have exited through the uni-directional gate. Only then is the entry turnstile unlocked, and the next load permitted onto the platform. The train is pulled up in a position that puts the locomotive beyond the public access point of the station, and so out of sight of the passengers. The advantage is that the driver does not have to deal with public enquiries and can concentrate solely on the job at hand. The disadvantage, of course—as any heritage operator would know—is that most people who come to ride a steam-hauled service are interested in looking at the steam doing the hauling. Despite the general 'unfriendliness' of the operation, it remains a successful organisation because it targets tourists (particularly tour coaches) wanting fast and easy access to the top of the Rothorn mountain; the steam locomotive is simply a gimmick. I guess that most of its customers are single-visit tourists rather than repeat business.

The Harzschmalspurbahn (HSB) is similar to the Brienz-Rothorn, but in a slightly different category. It has a network of three different railway lines, most of which are operated intensively by railcar services, while its signature service, Wernigerode to Brocken, is mostly operated by steam locomotives, and ten are needed in steam each day in order to fill the roster. What makes this different from the Brienz-Rothorn is that public access that is provided to the yard in Wernigerode where the locomotives are prepared each day for service, and tours of the steam locomotive workshop at Westerntor are available for a small charge. The locomotives are also accessible to the public when they pull up at the stations, and footplate staff were approachable.

OPERATING PHILOSOPHIES: HERITAGE AND TOURIST RAILWAYS CONT.

The Harz Mountains are a traditional tourist destination for Germans, but not yet very popular with overseas tourists; very little English is spoken in the town of Wernigerode, and HSB's website is only availabe in German, whereas many other railways have translations available in several languages. From conversations with other passengers on the train, HSB is a popular with the Germans, many of whom are repeat visitors, but less so with the overseas tourist market.

COMMERCIAL RAILWAY WITH HERITAGE LEANINGS: Making enough money to support heritage ...

These are commercial railways that share their history with their passengers through the operation of heritage trains on weekends and special occasions.

The Rigi Railway and the Schynige Platte Railway both operate intensive electric services, providing transport for hikers, skiers and day-tripping tourists. They operate their steam locomotives and heritage carriages on weekends and the staff working those trains dress in steam-era uniforms. Access to the locomotives is available at the stations, and the staff at the Rigi Railway, in particular, were enthusiastic about their heritage rolling stock and pleased to have the interaction with their passengers.

Most of these passengers were German-speaking (presumably Swiss), and it seems that repeat business is the stock in trade of these two operators rather than once-off tourists.

HERITAGE RAILWAYS: recreating a heritage experience...

Most operating preserved railways fall loosely into this category, where the railway is trying to recreate an experience, rather than faithfully recreating a service.

The four major, standard-gauge, branch-line railways in the UK (the West Somerset Railway, the Severn Valley Railway, the North Yorkshire Moors Railway and the Bluebell Railway) are all similar in their operations, which is to recreate, as far as possible, the experience of train travel during the steam era.

The stations have all been restored to look like they would have during the era, with vintage equipment, advertising signs and colour schemes. Staff are expected to wear appropriate uniforms, and (in the case of West Somerset, at least) staff that are required to wear orange vests in the course of their duties, are not permitted to do so in public places where vests are not necessary (i.e. on station platforms and footplates) in an effort toward authenticity.

Rolling stock is, insofar as possible, close to what would have been experienced in the steam era, although each organisation complies with accessibility laws and has wheelchair accessible carriages in their fleets.

Top: Rigibahn's guard dressed in period costume.

Right: Station buildings.
Top: The Bluebell Railway's station at Sheffield Park.

Middle: The West Somerset Railway's station at Bishop's Lydeard.

Bottom: The Severn Valley Railway's Bewdley Station.

MUSEUM PHILOSOPHIES:
TELLING STORIES

In this context, museum philosophy covers the story that the museum is trying to tell and whether it uses objects, models or interactive exhibits to do so.

Some museums choose a large story—the Deutsche Bahn Museum tells the story of the entire German railway system from inception to today, and the National Railway Museum at York does similarly with the British railways. These are complicated stories, including the development of motive power, different classes of travel, royal and other special trains, social history (how people travelled, who worked on the railways, what the jobs were like) and world history (putting the railways into context in line with world events, such as wars and coal strikes). These museums tend to be very large and tell their stories in small sections rather than as a single, seamless tale.

Deutsche Bahn uses models to convey complex ideas—such as the three different methods of changing wheels under a steam locomotive—which limits the need for complicated labels or very large objects that only tell a very small part of the tale. Deutsche Bahn, the German Transport Museum and the Lucerne Transport Museum also use extensive interactive exhibits to educate and engage, rather than relying simply on labels and objects in showcases.

The French railway museum, Cité du Train, tells parts of the story of its country's railway system through dioramas around each piece of rolling stock. Hence, the snow plough is surrounded by fake snow, the sabotaged WWII locomotive is laying over on its side in a pile of ballast and the long-distance train—with its sleeping berths made up in various stages of day to night—sits before a moving backdrop to give the impression of running through the countryside. The second part of the museum, the older section, is simply a long shed filled with lines of rolling stock with labels and an accompanying audio guide that explains steam locomotive development.

Other museums choose to tell a much smaller story more thoroughly. Le P'tit train de la Haute Somme's museum at Froissy tells the story of its own line, built to supply the front line in the Somme during World War I, its subsequent history and the later history of the locomotives that ran there (some of which went on to become industrial locomotives in various locations). This tidy little story is easily told using objects and labels, and the museum is not large enough to need interactive components to keep visitors engaged.

American railroad museums, such as the California State Railroad Museum and the Railroad Museum of Pennsylvania, simply tell the story of that state's railways. This is obviously a much smaller topic than of the entire country's railways and allows a more in-depth exploration. The California State Railroad Museum (CSRM) has narrowed its focus even further, choosing to concentrate on the ways in which the state's railroads changed life for Californians, although motive power development stories are still obvious within the museum—the enormous Baldwin cab forward sitting alongside the diminutive, 1873-built Baldwin *Empire,* for example. Like Cité du Train, CSRM relies on extensive dioramas to put each object into context in an engaging manner, and uses neither models nor interactives.

OBJECT PHILOSOPHIES: OPERATING OBJECTS

Not only do organisations need philosophies, but they need to have a philosophy for dealing with each of their objects. Often different items of rolling stock within a single collection (whether operational or static) will have very different philosophies applied for their care.

These range from pure preservation—keeping it safe from harm and decomposition without intervention—to repair and modification. These definitions are set down in the Riga Charter, developed by Fedecrail (see Appendix A).

SYMPATHETIC REPAIR: This is what I have called the kind of work that is carried out to return a locomotive as closely as possible to a state that it would have been in—aesthetically and mechanically—when it was in service. Boiler repairs are always carried out in a manner faithful to the original railway company's policy (where allowed by current regulations), and new parts are manufactured in the same manner as the originals. Of course, material specifications and sizes may make this kind of philosophy very difficult to maintain.

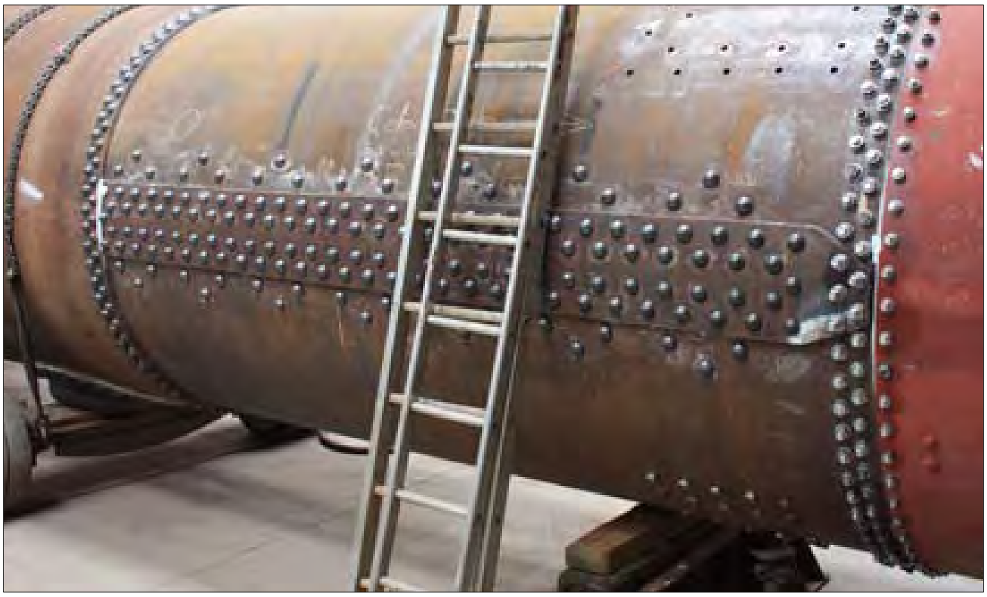
The advantages of this philosophy are that:

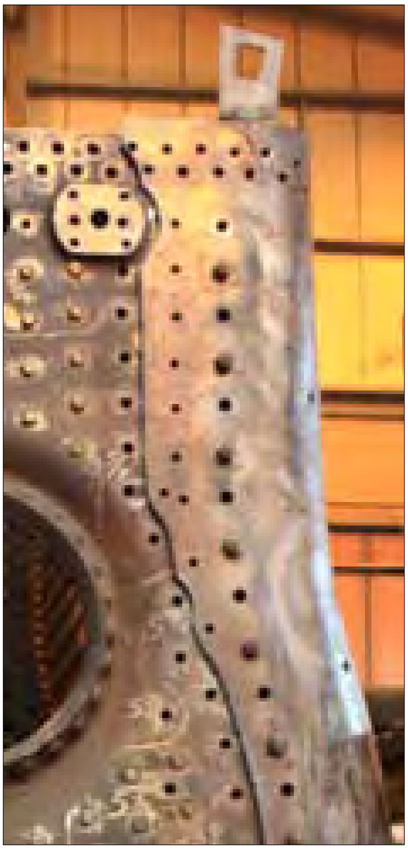
- although the fabric of the object has been changed and is no longer original, the new items are almost indistinguishable from the originals (proper practice, under the Riga Charter, would ensure that the replacement parts are distinguishable in some way, such as a stamping on the back of a valve body)
- it keeps the traditional locomotive building and repair skills alive

The disadvantages are that:

- it is generally more costly to replicate old repair practices—pressure welding is cheaper and faster than riveting, for example
- some modern practices are an improvement on old practices in terms of durability
- it is often difficult to find people who still have traditional skills

Although this philosophy is probably the most ethically sound for museum-based organisations that wish to operate their objects, it is probably the one least possible for economical and practical reasons.





Above left: The riveted double-butt strap of a boiler being traditionally constructed by R K Pridham & Sons in the UK. This company prefers to use traditional techniques, such as riveting, rather than modern ones, such as welding, in constructing new boilers and repairing old ones.

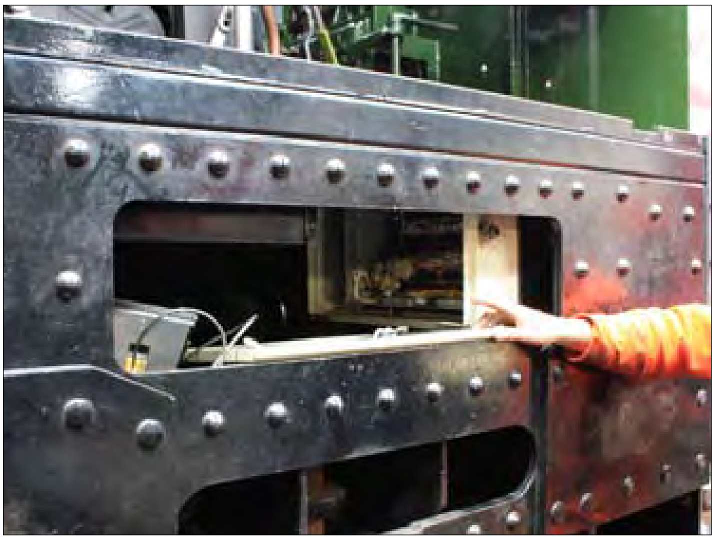
Above right: A backhead corner patch applied by the Severn Valley Railway was a traditional repair technique of some of the British railway companies.

OBJECT PHILOSOPHIES: OPERATING OBJECTS CONT.

PRACTICAL RESTORATION: Most heritage railway operators choose this middle course, trying to keep their operational rolling stock as aesthetically ‘original’ as possible, but making compromises on practical considerations. For the sake of this report, I have chosen to call this ‘practical restoration’, and locomotives thus treated generally operate on railways that fall into the ‘recreating a heritage experience’ category.

Compromises on these kinds of locomotives can be as minor as using 6 mm spark arrestor mesh because ¼-inch mesh is no longer readily available, or replacing horn liners with a harder wearing modern equivalent. The injector pipe on Southern Pacific *Daylight* No. 4449 has been fitted with a small plug, for example, to allow easy slug dosing of boiler water treatment when the locomotive is in steam, without the need for adding the treatment to the tender water and then wait for it to mix and for enough water to be added to the boiler to change the treatment ratio. This is a minor addition that is unlikely to ever be noticed by a member of the public, but means that maintenance is made much easier, and probably increases the life of the boiler by reducing the amount of time and water in balancing the water quality.

Extra plug in the injector delivery pipe on Southern Pacific *Daylight* 4449.



Train protection warning system equipment hidden beneath the floor of *Earl of Mount Edgcumbe* at Tyseley Locomotive Works.

Main-line locomotives in the UK must be fitted with air compressors, data loggers and train protection warning systems before they are allowed on the network, and organisations such as Tyseley Locomotive Works specialise in fitting these items ‘invisibly’, hiding them under cab floors and between frames.

King Edward I, for example, has an air compressor fitted beneath the boiler, between the frames and clear of all the conjugating gear; an awkward position for maintenance, but out of sight to all but the most determined of viewers.

The disadvantages of hiding the extra equipment away are:

- that the engineering needed to fit items invisibly is often more complicated than having them fitted in plain view
- that maintenance and inspection of these items is usually made incredibly difficult by such placement.

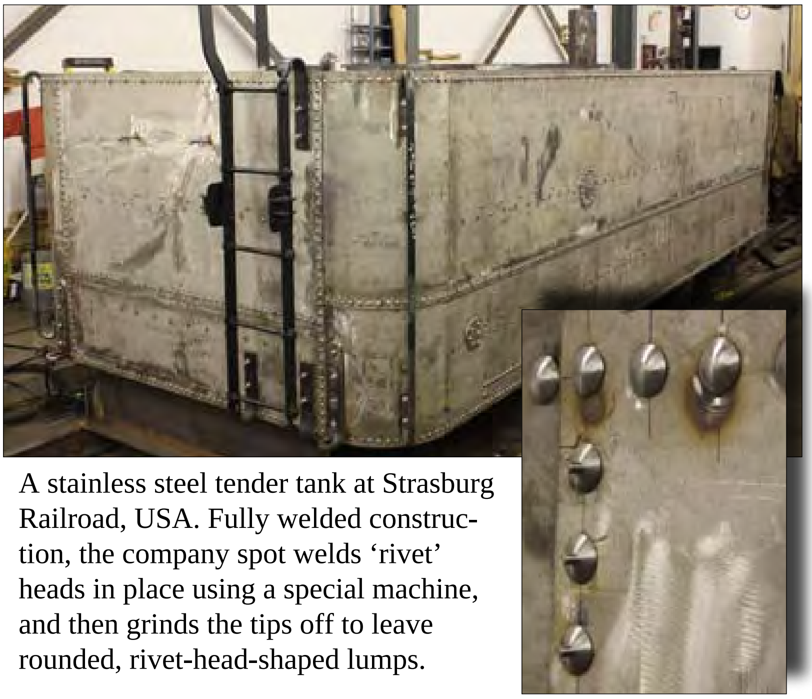
Most organisations feel that the aesthetic concerns override these disadvantages, and prefer that their rolling stock looks as close to what it should have when it operated in general traffic.

It can also be argued that hiding the gear away is in direct conflict with the conservation ethics of ensuring that additions and changes to an object are immediately obvious and easily verifiable, but this can be countered with the argument that many people do not know that a certain locomotive was never fitted with an air compressor while in normal service, and therefore there is little point in confusing them by putting it out in the open where they can see it.

OBJECT PHILOSOPHIES: OPERATING OBJECTS CONT.

The Strasburg Railroad constructs new tender and water tanks from stainless steel to avoid the corrosion issues of mild steel, and then spot welds ‘rivet heads’ to the outside so that the tanks look the same as they would have originally. Although an organisation with a purer museum focus would say that such integral changes to the construction are unacceptable, Strasburg argues that the decrease in maintenance costs justifies the divergence and that passengers and visitors never know the difference anyway.

Practical restoration can generally be accepted to mean that the compromises that have been made to the locomotive, while often invasive, are not obvious, nor do they radically affect the operation of the engine.



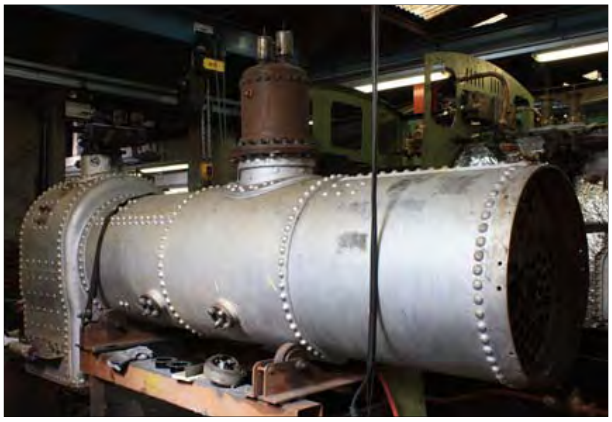
A stainless steel tender tank at Strasburg Railroad, USA. Fully welded construction, the company spot welds ‘rivet’ heads in place using a special machine, and then grinds the tips off to leave rounded, rivet-head-shaped lumps.

INNOVATIVE INTERVENTION: The Ffestiniog, on the other hand, have a policy I have chosen to call ‘innovative intervention’ for their ‘Lady’ class locomotives, which they’ve decided are not important historically. Innovative intervention includes major modifications to locomotives that materially affects their aesthetics and operations.

The ‘Ladies’ were originally saturated engines, but the company has superheated them and was in the process of re-valving them while I was there to improve their operation on the railway. These kinds of major modifications mean that the locomotives are no longer true representatives of the class, but the railway argues that they are preserving the spirit of innovation within the railways, rather than the objects themselves, and that these kinds of modifications are a logical step that the original company would have taken.

A difficult entry in this section is the argument between conversions to coal from oil and vice versa. Organisations like the Ffestiniog converted their locomotive fleet from coal burning to oil burning when the cost and availability of coal made its purchase uneconomical. Although this conversion required enormous modifications to the fireboxes of the converted locomotives, the railway would not have been able to thrive had it not taken this step. Now, with the costs of fuel oil becoming prohibitive, they are looking to reverse the process, and perhaps convert their original oil burning locomotives to coal.

Fuel conversions debates are likely to increase in the future with environmental considerations about the types of fuel burned, and organisations will need to examine whether or not they are willing to begin such interventionist modifications to their locomotives, or whether they will continue to use the fuel for which their locomotives were originally designed.



Newly superheated boiler from Lady locomotive *Linda* in the Ffestiniog’s Boston Lodge workshops.

OBJECT PHILOSOPHIES: MUSEUM OBJECTS

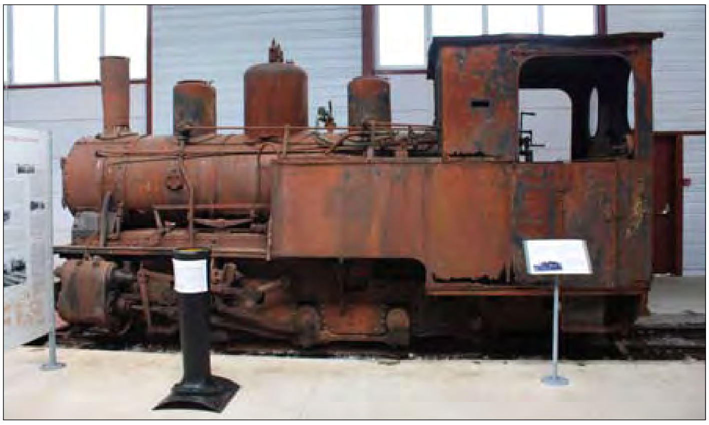
Museums have even more complicated issues to consider: should an item of rolling stock be operated, as the National Railway Museum at York is planning to do with *Flying Scotsman*, or should it be preserved within the museum to stop it from wearing out, like *Mallard*? Should an item be presentably conserved, like most items of rolling stock within most museums in the world, which have been cosmetically overhauled to look as good as—or in some cases, better than—new? Or is the original fabric so precious or is the story it tells in this condition so interesting that it should be conserved 'as is', which is what Le P'tit train de la Haute Somme chose to do with one of their German-built locomotives.

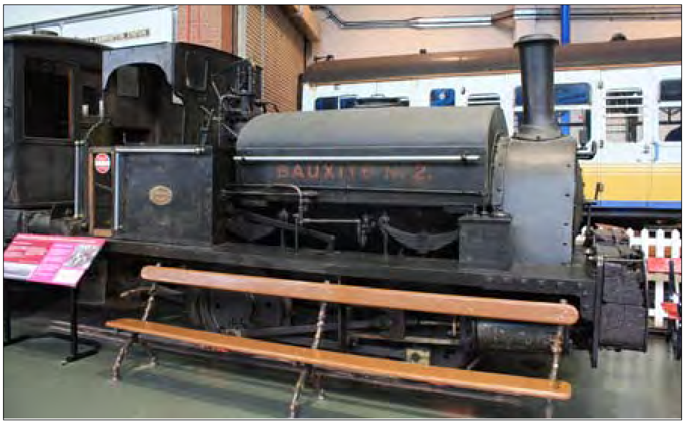
Some of the questions that these organisations ask when determining a treatment method for an object include:

- how unique is the locomotive? Different concerns might be raised for the single remaining representative of a locomotive type than for one that is just one of many that still exist. *Mallard*, for example, is a unique locomotive because it broke the land speed record, and therefore is an important representative of its class. With three other A4s operational, however, there's probably not much need for it to also be returned to service, and the National Railway Museum has chosen to keep it conserved on static display.

- how much of the original fabric still exists? If the locomotive was badly damaged, or has been greatly modified since its withdrawal from service, it is possibly a good candidate for restoration or repair. *Flying Scotsman*, for example, has been extensively operated in preservation, and so much of the original fabric has been contaminated. This makes it a good candidate for major overhaul and return to service.

- how much of the original fabric will need to be replaced in order to make the locomotive operational? If a locomotive within a museum is relatively intact—and therefore presentable for display—but will lose much of its original fabric in order to return it to service, it is possibly a candidate for presentable conservation rather than return to operation.





Above left: The German narrow-gauge tank engine 'preserved' and on display at Le P'tit train de la Haute Somme's museum at Froissy.

Above right: Industrial locomotive *Bauxite No. 2* at the National Railway Museum at York has been 'conserved' to protect the original paintwork, rather than cosemetically overhauled, like *Mallard*, left.

OBJECT PHILOSOPHIES:
COLLECTING POLICY

A comprehensive collecting policy should be developed with reference to the organisation's philosophy and how they wish to conserve, preserve, present, repair or reconstruct and operate their objects.

Collecting policies are important to ensure that the objects within any collection suit the philosophy of that organisation, that they are useful to that organisation and to help control the collecting impulses of many of its members.

A collecting policy details:

- the parameters for collecting objects to ensure that the objects . A narrow-gauge organisation should not be collecting standard-gauge objects, for example, and a museum that promotes itself as a 'steam train museum' should probably only acquire other forms of traction for use in shunting. An organisation that wishes to represent a particular era should concentrate only on objects applicable to that time period. A main-line operator should probably not be interested in collecting tiny tank engines that are not capable of the distances or speeds to run main-line traffic, while branch-line operators should be careful not to acquire locomotives that are too heavy or too fuel-hungry for their operation. The Railroad Museum of Pennsylvania had a number of locomotives within its collection that did not work within the borders of its state, and therefore did not fit within the museum's philosophical parameters of telling the story of that state's railroads.

  The parameters should not only apply to the objects themselves (in this case, steam locomotives), but also to tooling and spares. An organisation that only has locomotives fitted with hydrostatic lubricators, for example, should only add a mechanical lubricator to its spares collection if its philosophy allows it to modify the lubrication system of the locomotive.

- the process through which the organisation must proceed in order to add to its collection. If an item is offered to the organisation, what process should be followed to acquire it? Who within the organisation can make the decision to accept or refuse the item and who can set aside any money needed for its acquisition? Should the item be inspected first, should a complete condition report be made and who is the appropriate person to carry out these tasks? Where should the item be delivered and should it be held in quarantine before being added to the collection?

- the process through which the organisation must proceed in order to dispose of items in its collection. How does the organisation determine that an item is surplus to requirements or does not fit with the philosophy? Should the item be offered to sale on the open market, or should it first be offered to another organisation?

- any objects that the organisation feels it should acquire to complete its collection or to assist in telling its story. These are often listed in different categories that specify whether an object is necessary to the collection or simply desirable.

Because it is so closely tied to its philosophy, each organisation's collecting policy is unique, and no single policy can fulfil the requirements of every organisation.

Some things that organisations consider when developing a collecting policy include:

- what that organisation is trying to achieve and how that can be done in practical terms

- how much room an organisation has to house its collection. If an object becomes available that is considered necessary, but there is not enough space for it, should an item of lesser importance be disposed of to make room?

OBJECT PHILOSOPHIES:
COLLECTING POLICY CONT.

- the resources available to care for its collection. Should the organisation accept an item into its collection if it cannot care for it? Should an operating railway, for example, acquire a life-expired locomotive to use on its trains if that organisation doesn't have a workshop and mechanical skills available to it, or the money to pay for another organisation to carry out the work for it?

- the kind of object treatment philosophies that the organisation wishes to employ on its collection. If an organisation that believes in minimal intervention with an object is offered something for display that it cannot exhibit without massive intervention, is this object suitable for its requirements?

- whether it might be considered better not to accept an object into a collection if the organisation is not certain of its value or necessity. De-accessioning objects is often a stressful process for an organisation, as individuals within that organisation have usually invested their own time and sometimes even their own money in the acquisition and upkeep of an item and, therefore, can become emotionally attached to them.

Of course, no one of these points above can be taken out of context with all the others. An object that is necessary to complete a collection might be accepted despite its poor condition, for example, or an item that doesn't strictly fit within the purview of the collecting policy might be accepted because it can bring a benefit to the organisation in another way.

Left: This Nickel Plate Railroad locomotive is one contentious object within the Railroad Museum of Pennsylvania. Collected many years ago when the organisation was forming, it has a special place in the hearts of many within the museum. Given that the Nickel Plate Railroad only operated *across* a small corner of the state and not within it, however, some feel that this locomotive has no real place within a museum aiming to tell the story of railroading within the state of Pennsylvania.

OBJECT PHILOSOPHIES:
SOME CONCLUDING REMARKS.

There are no 'right' answers for how a locomotive or a collection should be treated, and different organisations often have very different ideas about how any given object or item should be cared for. Arguments in favour of conservation and preservation of moveable heritage (such as locomotives and vehicles) as opposed to operating include the principle that all operating objects will eventually wear out, and that subsequent repairs continually alter the original fabric until the original object no longer exists.

Arguments in favour of operating include the very valid idea that a complex object that is no longer within the understanding of the general public is more readily interpreted if it is operating.

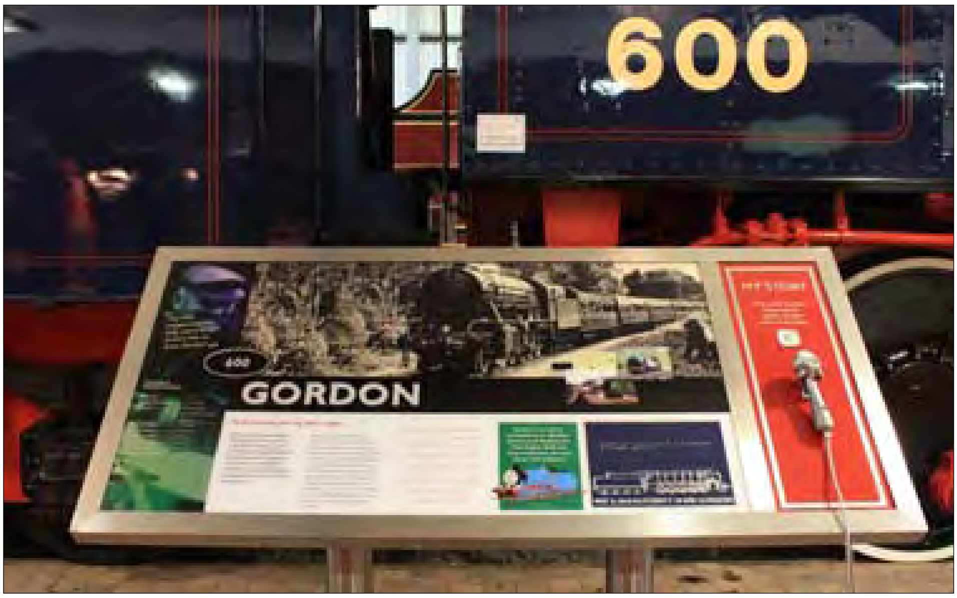
There are also widely differing opinions about when (or if) the 'life' or 'story' of an object ends; should a locomotive's history end at the point that it ceased working for a commercial railway, and therefore not modified or developed past that point? Or is its life in preservation part of its history, and their modification and redevelopment therefore a valid extension of this?

Again, organisations return to their over-arching philosophy about what it is they are trying to achieve to help them answer these questions.

INTERPRETATION

How museums interpret complex objects such as steam locomotives to an audience that no longer has any understanding of the principles of steam power is an interesting problem. Obviously, the easiest way in which to interpret large mechanical objects is to operate them, but this is not always possible.

LABELS: These are probably the simplest way to get a message across. They are relatively inexpensive and easy to manufacture, and don't require much maintenance.



The best labels I saw were at the Severn Valley Railway's museum at Highley. They contained technical specifications, a personal 'quote' from a driver about the locomotive or class and the locomotive's provenance (or history). These labels also included an audiophone for more information or for the visually impaired, and a raised outline of the locomotive to allow a visually impaired person to understand the shape of the engine.

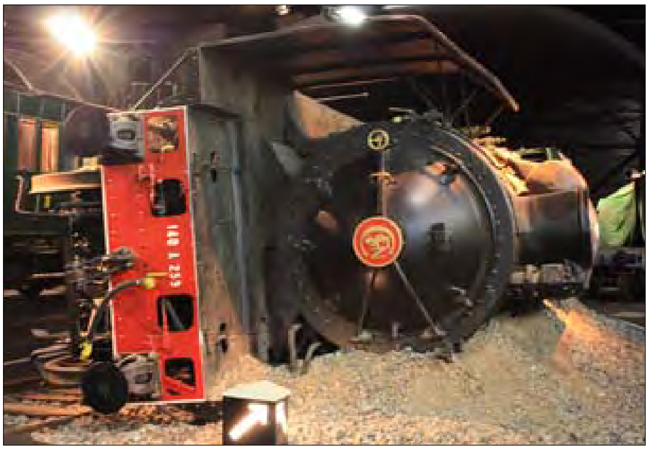
Another worthwhile idea for labels was translations; La P'tit train de la Haute Somme's labels were in French, German and English, the languages spoken by their most common visitors. These translations were not available in most English or American museums, although foreign language catalogues and printed guides generally were.

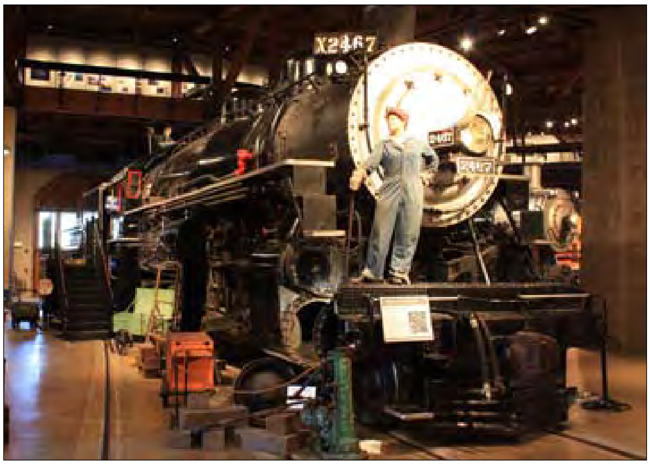
An alternative to labels and translations are audiophones. Cité du Train had audiophones available in English, German, French, Spanish and Italian, which certainly enhanced the experience for this non-French-speaking visitor!

However, these audiophones require a fair amount of maintenance—Cité du Train's did not work in half of the exhibits—and probably cost more for the initial set up than the labels.

DISPLAYS: The amount of labelling can be reduced by putting the objects into context in their displays, which was something that both Cité du Train and the California State Railroad Museum (CSRM) did particularly well. Cité du Train had a damaged locomotive laying over on its side in a recreation of an accident caused by the French saboteurs during World War II, a snow plough in fake snow and a locomotive sitting beneath a water column. CSRM had a locomotive heading into a snow chute, one in pieces in a workshop setting and one up on a 'trestle bridge' in the roof space.

A couple of other displays at both organisations are worth mentioning, even though they did not involve steam locomotives. Both museums had a day-night





Top: Cité du Train's sabotaged locomotive.

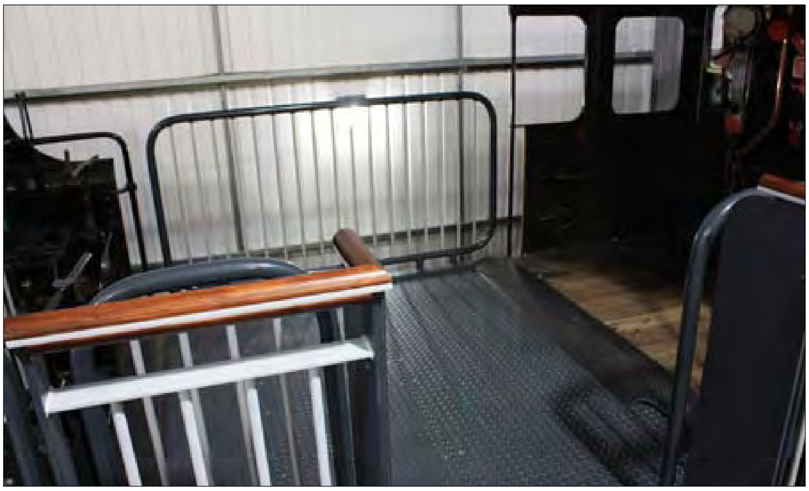
Bottom: California State Railroad Museum's workshop diorama, featuring 'Rosie the Riveter'.

Cité du Train’s dining room exhibit on the left and the California State Railroad Museum’s on the right.

sleeping carriage on display showing a gradual transformation from day to night as the length of the carriage was traversed. A moving scene behind the French one—similar to what is used in the movies to simulate movement behind a vehicle—gave the feeling that the carriage was moving through the countryside. The American version had the windows darkened and an audio and series of lights along the length of the carriage gave the impression of crossing level crossings and passing signals. Particularly ingenious, in CSRM’s carriage was a small electric motor driving an eccentric shaft that bumped the carriage on its springs every few seconds, simulating the feel of such a carriage in traffic. Both organisations also had a dining carriage set up for dinner—Cité du Train’s was visible from the platform and only really showed the dining area clearly, while the interior of CSRM’s was accessible, and each table was laid out with a setting from a different railway company or era. The china was protected by domed Perspex shields, like enormous cheese tray covers, on each table. Because of the interior access, CSRM’s carriage’s kitchen was also visible. One final non-locomotive-based display that is worth mentioning is the State Railroad of Pennsylvania’s station building and street front, which has been built inside their main display hall. Kitted out in period furnishings, the nicest touch with the telegraphic office/ticket office was the small display of Morse code machines and the accompanying audio which was simply the clatter of Morse code rather than the expected forced dialogue between intending passengers.

Other museums also had impressive locomotive displays. The Franklin Institute in Philadelphia had a steam locomotive on a pulley that moved a couple of metres along its track, although as the locomotive moved so slowly along the track, I’m not really certain if there was any great educational value in this exhibit other than to show the movement of the motion, something that could have been achieved by putting the wheels on rollers.

Most museums allowed access into a steam locomotive cab. The National Railway Museum (NRM) at York opened *Mallard’s* cab to public access at a set time each day, where a volunteer gave a short talk and answered questions, and Lucerne had a similar program in place with one of its locomotives. CSRM’s enormous cab forward was open for visitor access throughout the day, and again was staffed by a volunteer to answer questions. The Baltimore & Ohio had two locomotive cabs open to the public, one of which was a derelict and gave children the opportunity to play with levers and handles and had a brief audio and lights in the firebox. The Severn Valley Railway’s steam locomotive cab access, however, was wheelchair accessible by the simple expedient of running a ramp up to the height of the cab floor, separating the engine and tender and putting a platform between the two.


The Severn Valley Railway’s disabled access into their public-accessible cab.

INTERPRETATION CONT.

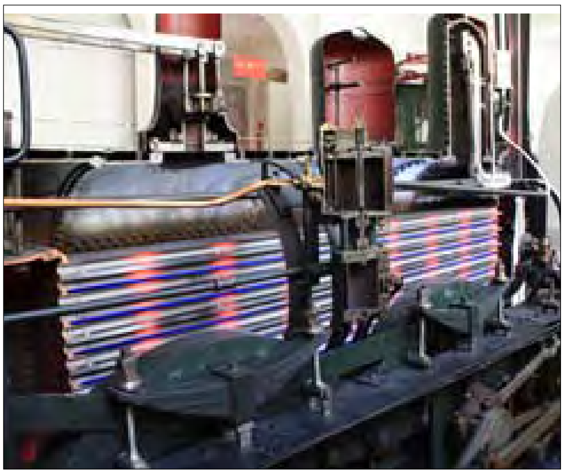
The National Railway Museum at York demonstrate their turntable inside the Great Hall every day.

NRM demonstrate their turntable each day; a locomotive ‘spinning’ on the table in the middle of their display hall was a very impressive sight that draws large, appreciative crowds. The West Somerset Railway had just installed a turntable at their terminus at Minehead within view of their new outdoor cafe area when I was there. This allows the public to see the locomotives being turned before heading a train back towards Bishops Lydeard, and the railway expected a lot of public interest in this activity (as is always the case when locomotives are turned during public events at the Rail Transport Museum at Thirlmere).

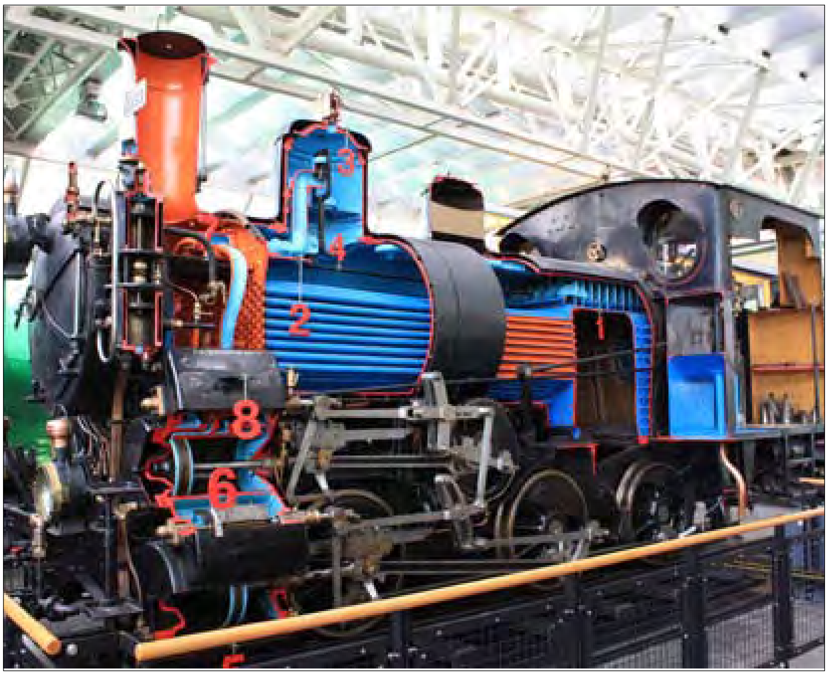
NRM, Cité du Train, Deutsche Bahn and the Lucerne Transport Museum all had sectioned steam locomotives to illustrate how a steam locomotive works. Of all of these, Lucerne’s was probably the most impressive exhibit; this locomotive was demonstrated at set times by a staff member, and accompanied by an audio narrative that explained the processes while spotlights highlighted the areas under discussion. The driving wheels were on rollers that started up at an appropriate time during the demonstration, and allowed a view of the moving valves and pistons. An added bonus was that this locomotive is a rack engine; the rack gear has also been sectioned and was operated as part of the demonstration.

Deutsche Bahn’s sectioned locomotive had different coloured LED lights running in series through the various sections (red for fire and hot gases, blue for water, white for steam) to show the passage of fluids through the boiler. These were push-button operated by the visitor, who could choose to light up only one or all together.

The Lucerne Transport Museum, NRM and the Railroad Museum of Pennsylvania (RMP) each had an access pit for visitors to view beneath a steam locomotive and see its workings. CSRM’s solution was to put a mirror beneath one of their locomotives, and Cité du Train’s overturned locomotive did the same job without the need for a pit.



Above: LED lights showing fluid movement in DB’s sectioned locomotive.



Right: Lucerne Transport Museum’s sectioned locomotive.

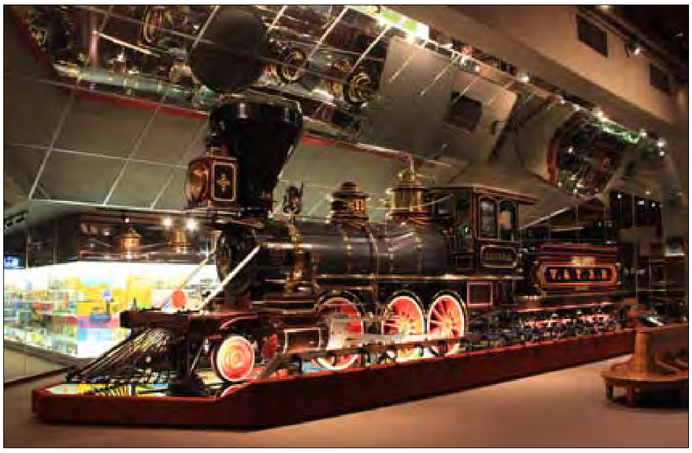
All the railway museums I visited had a model train (HO or O gauge) layout of some sort. Deutsche Bahn had two—one a series of dioramas depicting the same village during different periods, which was useful to illustrate changes throughout history, the other a more usual type of layout. In all cases, except the Deutsche Bahn dioramas, although they were incredibly popular, I'm not sure of the educational benefit. There was, in some instances, a monetary benefit; Lucerne charged two Francs a time to operate theirs.

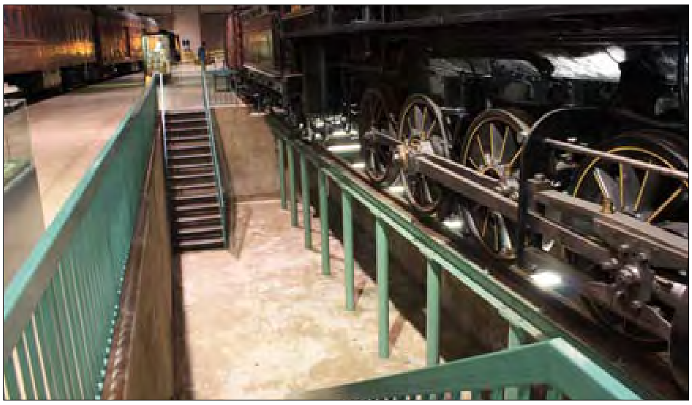
MODELS: Deutsche Bahn in particular excelled in its use of models to explain complex ideas rather than take up valuable floor space with large exhibits that only told a small part of an entire story.

INTERACTIVES: Large museums such as Deutsche Bahn and the Lucerne Transport Museum that don't use dioramas to put their objects into context use a lot of interactive exhibits to keep the audience engaged, some of which were fairly complicated. These included shunting games, learning the use of signalling equipment and experiments to determine what kind of rail gave the least amount of rolling resistance.

The Severn Valley Railway had a particularly simple and cheap, but very clever, interactive in the section of their museum that dealt with maintenance and restoration. A hammer was provided to ring test the wall stays in a section of firebox with the aim of determining the broken stays from the sound. This proved a very popular (although noisy) interactive.

Locomotion at Shildon also had a couple of simple but engaging interactives, such as their shunting game, where coloured wagons in a marshalling yard have to be shunted into the position dictated by a row of random coloured lights.

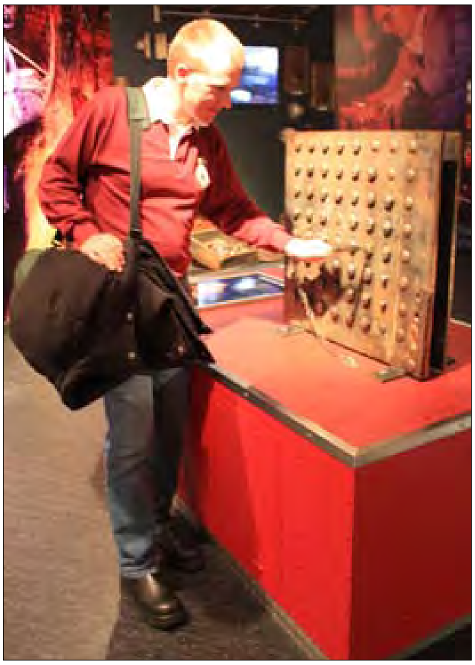




The California State Railroad Museum's mirror-surrounded locomotive (top) and the Railroad Musuem of Pennsylvania's access pit (above).

Other interactive exhibits included a firing exercise for young children using a wooden shovel and foam coal.

Above: Part of the Severn Valley's workshop exhibition in their museum, including video footage of maintenance and reconstruction.



Right: The wall stay ringing interactive exhibit that makes up part of the workshop exhibition.

LIVE THEATRE: Because railway museums are not, by their nature (filled as they are with large objects), inclined towards regular refurbishment or refreshing, and exhibition or object changeovers are rare, museums such as NRM use other, innovative means of attracting repeat visitors, such as live theatre. In conjunction with York Theatre Royal, the current NRM production is a theatrical adaptation of *The Railway Children*, with the audience seating along a platform and featuring one of the museum's locomotives.

PHOTOGRAPHIC EXHBITIONS: Another method of exhibition changeover is to put aside an area of the museum for temporary photographic exhibitions; both the Railroad Museum of Pennsylvania and the California State Railroad Museum had exhibitions of steam locomotive photographs on display when I visited.

OTHER SPECIAL EVENTS: Museums also use special events to entice return visitation. Many museums hold special steaming events; the California State Railroad Museum has held three 'railfair' events where operational locomotives are invited for display from right across the country, and even from overseas. One example of an innovative program at one of these events was a time/speed trial for Shay locomotives (built for tractive effort, not speed). Other special events include *Thomas the Tank Engine* days and *Polar Express* trains in the lead-up to Christmas.

OPERATING LOCOMOTIVES: This is the easiest way to interpret a steam locomotive—although it can be argued that it conflicts with sound conservation and museum ethics by wearing out othe object's original fabric—and many of the museums I visited have some kind of operating program.

COLLECTION MANAGEMENT: OBJECT CARE

Many organisations in Australia and overseas have many more objects than they can care for appropriately, a result of the scramble to save rolling stock when the railways were disposing of them for scrap. As these organisations very rightly claim, many of these items would not exist today had they not been saved from the scrap merchant's torch by the efforts of these organisations thirty years ago. Unfortunately, the sheer size and weight of railway objects—steam locomotives in particular—and their complexity in terms of conservation has meant that rationalisation has become necessary.

Recognising they couldn't care for their entire collection, the California State Railroad Museum recently de-accessioned around thirty pieces of rolling stock, donating them to other appropriate organisations. This process involved going back to the museum's philosophy, and debating which objects had the most importance in terms of fulfilling the museum's goal of educating about the role that the railroads in California played in the lives of the people in the state.

This was, naturally, an incredibly painful process for the museum, because every item within its collection was there because someone in the organisation found it, saved it, bought it, wanted it. Money has since been spent on its care, and the time of staff and volunteers has been invested in it.

The museum admits, however, that it felt it was more important to reduce the collection to a size that it could manage and house properly, rather than allow the entire collection to suffer.

The National Railway Museum at York has a slightly different approach, and loans its 'excess' objects out to other organisations to put on display (as at Severn Valley) or to operate under the (as at North Yorkshire Moors Railway). The benefits of this program are that the objects themselves are still retained within the national collection, and are now more widely accessible to the public.

The proper management of these loan agreements, however—particularly for the operational locomotives—is very heavy on resources, and the NRM has had to remove a number of locomotives from their lessees in recent years because the standards were not being upheld. The NRM's loan agreement is available on their website, or by contacting me at the email address at the front of this document.

STORAGE: Adequate storage is often difficult to achieve for items of rolling stock due to their size and weight. Many organisations store items outdoors, with no protection, where they are vulnerable to vandalism and corrosion, both of which significantly reduce the life the object.

The Railroad Museum of Pennsylvania has a number of locomotives stored out in the open in their yard. Every six years these locomotives must be repainted, in an effort to slow their decay, and it costs approximately US $6000 per locomotive to complete this job properly. According to staff, these items of rolling stock sitting out in the yard cost more to maintain each year than the benefit—either monetary or educational—that they bring to the organisation.

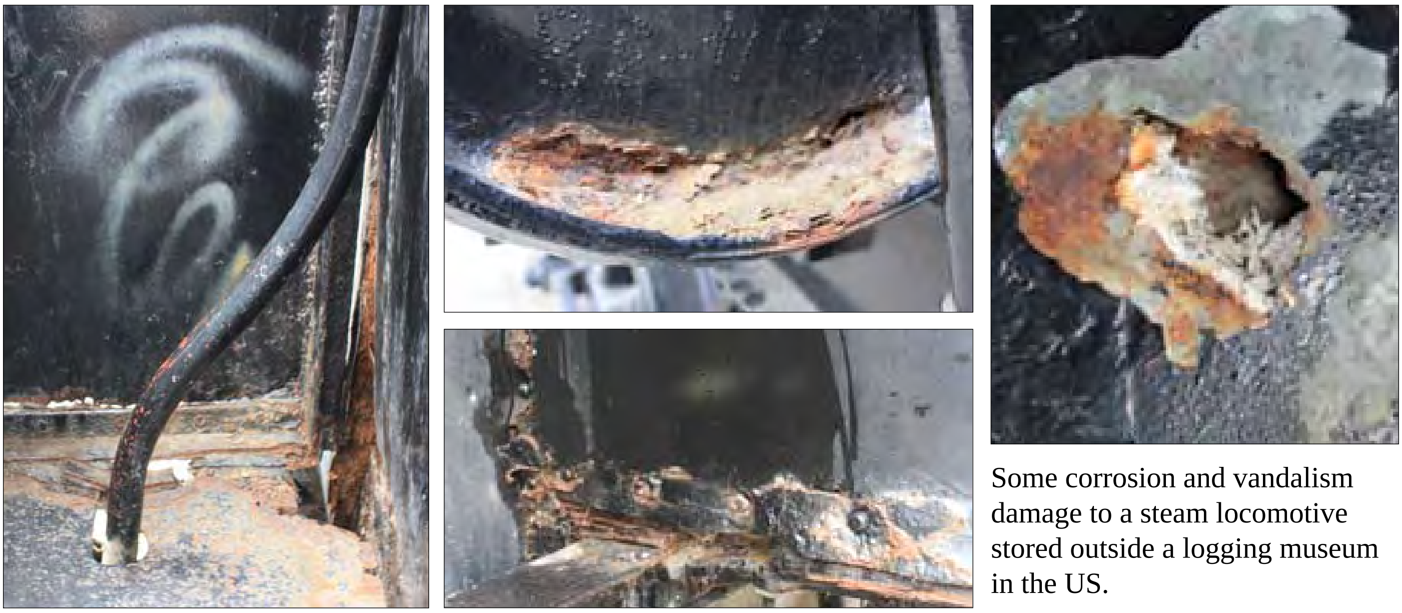
Although outdoor storage should only ever be a temporary solution to an accommodation issue, it is often the only option available to many organisations.

Above: Althoguh this Shay on outside display in Portland could use some stablisation work, it does at least have a partial cover overhead.

COLLECTION MANAGEMENT: OBJECT CARE

Some things that can slow the deterioration of steam locomotives thus stored include:

- complete ash removal from the firebox and smokebox using dry removal techniques (such as vacuuming or brushing, not by washing out)
- removal of all boiler lagging beneath the clothing/cladding
- opening clothing/cladding at the bottom to prevent water pooling
- covering any open holes in the top of the boiler (such as where boiler mountings have been removed)
- removing washout plugs in the bottom of the firebox and the belly plate to allow drainage of any water collected
- covering the top of the funnel
- application of wax or grease to all dry bright work
- covering all axleboxes to prevent water ingress
- regular applications of paint as a protective covering

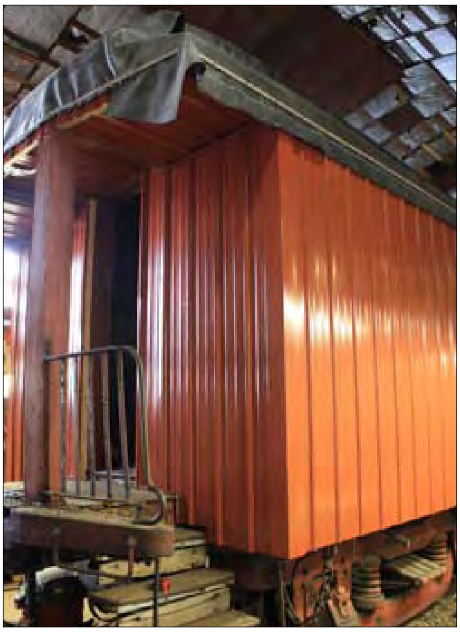


Some corrosion and vandalism damage to a steam locomotive stored outside a logging museum in the US.

NOTE: Although the following applies only to carriages and thus was not within the purview of my study, I thought it was worth including for interest's sake.

The Strasburg Railroad and the Railroad Museum of Pennsylvania 'cocoon' wooden-bodied carriages set aside for long-term, outdoor storage. This involves completely covering the roofs with rubber, with overhang to ensure that water running off the roof falls clear of the body and doesn't track up beneath it. All the sides are encased in painted tin (Colourbond-type sheeting) and fixed to the woodwork beneath with fixings like Tek screws. The sheeting protrudes further than the bottom edge of the woodwork, again to ensure that water drips away and does not track up inside, and the bottom of the sheeting is left open to allow the wood to breathe. Not only does this protect the carriage from rain and sun, but also from the depredations of vandals, and helps to make what are sometimes quite shabby carriages look somewhat more presentable.

Conditions in this area of Pennsylvania are often very humid, and both organisations said they have had good results with this type of protection—carriages thus cocooned for up to ten years have been readily been returned to service or been done up for display.



A carriage in the process of being 'cocooned' to protect it during outdoor storage in the humid climate of Pennsylvania.

COLLECTION MANAGEMENT: OBJECT CARE

COLLECTION CONSERVATION AND PRESERVATION: Very few of the museums that I visited have conservation professionals on the staff—in most instances, conservators are either contracted in for a specific project or, more usually, the curators take a share of this burden themselves. In museums that have only permanent exhibitions (i.e. those that are not changed over regularly), once the stabilisation work and environmental controls are in place, only object cleaning is required regularly, unless objects are damaged or defaced.

Most of the items of rolling stock on display were within touching distance of the general public. Bright work on locomotives was often coated with lacquer or painted silver to protect against corrosion from the salts on people's skin, but these protective coatings must be maintained regularly, particularly in 'high traffic' areas, to continue to work. It is generally accepted that objects made predominantly of steel are more robust than ones constructed of wood or fabric, but steel will still degrade over time if exposed to the salts and moisture from hands.

Many of the museums had double door entry i.e. the museum space did not open directly to the outside, reducing dust ingress and preventing air from the outside from directly or immediately blowing on objects.

The California State Railroad Museum was the only museum I visited with full environmental controls in place within its display spaces, although it is still working towards this in its stores. The entire museum is air conditioned, keeping the objects at a constant temperature and humidity, and reducing the stress of diurnal cycles. The Baltimore & Ohio had a small area of fragile objects that was air-conditioned, while the National Railway Museum and Cité du Train both had light-sensitive objects in areas with controlled lighting levels to prevent fading.

Most European museums do not seem to feel that air conditioning is necessary, possibly because of their relatively low temperatures and humidity levels, although museums in America, as in Australia, certainly understand the benefits of fitting HVAC systems. The Railroad Museum of Pennsylvania does not yet have environmental controls in its display hall, although it has been actively seeking funding to install a system. It has, however, purchased a number of shipping containers and fitted these with full HVAC systems and stainless steel storage racks, and uses these containers to store some of the more fragile small items in the collection.

Some areas containing light-sensitive or otherwise fragile objects, such as the station hall at the National Railway Museum, had controlled lighting levels.

A tender has been built for the Darjeeling locomotive No. 19 on the Beeches Light Railway to give it greater operating capacity and to carry an air compressor. This has allowed the locomotive to be operated on other lines, such as the Ffestiniog and the Leighton Buzzard, without making major modifications to the original fabric of the locomotive.

FUNDING

Although I did not originally intend to cover this topic in my study, it seemed obvious once I had begun my fellowship that how organisations afford the work they do on their locomotives was of major importance.There were a number of different (and sometimes innovative) funding streams available.

RUNNING TRAINS: This is the most obvious ways in which all these organisations make money and most of the organisations I visited run steam trains of some sort. Some operate day-long excursions, such as *King Edward I* and the Durango & Silverton Railroad, some take around three hours to complete, and the duration of others can be less than an hour.

The shorter duration trains, or those with a number of ticketing options that allow passengers to hop on and off along the line at whim and choose the length of their ride, are the ones most popular with famililes; children become bored sitting still on a train for eight hours at a time, regardless of the motive power, and I saw no children on board those longer trips that I did.

This means that these longer trips have limited appeal to an entire section of audience, and only organisations that are very sure of their popularity among other groups can afford to ignore this fact.

Branch-line railways that do well in both Continental Europe and the UK are those with several stations or stops along their route and offer ‘day rover’ tickets that allow passengers the freedom to disembark and explore alongside the line. These tickets are very popular with hikers and walkers, who might catch the train one way and walk the other, or walk a section between stations. They allow passengers to combine more than one activity in a day, and so are very attractive in a time-starved society.

A corollory of this, of course, is that many of these railways actually take people somewhere they wish to go. The West Somerset Railway, for example, takes its passengers to the seaside town of Minehead, while the Harzschmalspurbahn, the Brienz-Rothorn and the Rigibahn take their passengers up to the summit of a mountain to enjoy the views. The Durango & Silverton Railroad takes its customers through largely inaccessible country and into the old silver mining town of Silverton, where they can enjoy lunch at a number of venues and purchase locally made souvenirs.

If the railway doesn’t go somewhere that people want to go, the organisation needs to make a reason, such as building a restaurant at the terminus. The Schynige Platte Railway, for example, has planted an alpine botanic garden at the end of its mountain run.

Another consideration, of course, is whether or not the passengers enjoy their trip, and whether or not they will return or recommend the railway to their friends. The Chairman of the West Somerset Railway regularly rides his trains as a normal passenger, and tries to look at the operation through the eyes of his customers.

SPECIAL EVENT TRAINS: Popular event trains are *Thomas the Tank Engine* days and *Polar Express* trips. The Americans also run a lot of Autumn (Fall) Harvest specials and Halloween trains. North Yorkshire Moors, Severn Valley and West Somerset run special theme events where passengers and staff are expected to dress up for the occasion, such as 1940s or 1960s days; these are particularly popular on the North Yorkshire Moors Railway, which runs through ‘Heartbeat’ country. Troop trains and war-era events are also popular with these railways.

COMMERCIAL TRAINS: Rigibahn and Schynige Platte run intensive daily services of electric- and diesel-hauled trains as a commercial venture, and use the steam locomotives only on weekends and special occasions. The steam program for both is fully self-funded by their normal tourist trains.

Harzschmalspurbahn runs intensive railcar services elsewhere on their network, including commuter trains.

MERCHANDISING: Every single operator and museum had souvenirs of some sort available. Many of the branch-line operators had a number of shops along their routes; some had a souvenir shop at every station on their line. As well as shops on their stations, HSB had a stand-alone merchandise and ticket shop within the medieval market town of Wernigerode.

Many of the UK railways allow the groups that run each of their stations to stock and manage the shops on their stations, with all proceeds from those shops going back into that station group's coffers.

Interestingly, the North Yorkshire Moors Railway allows the group that owns *Sir Nigel Gresley* (which operates on their line) to have a dedicated stall within one of their souvenir shops, selling merchandise for that locomotive, with proceeds going back to that group for the loco's upkeep. These items were all in 'A4 blue' and the stand was instantly recognisable in the shop.

Similarly, the National Railway Museum at York had a dedicated stand of merchandise to support the reconstruction work on *The Flying Scotsman*. This merchandise was generally in 'A3 green'.

Items that were available for sale included:

- Stock book
- Line book or booklet
- Calendars
- Hats
- Clothing (rugby shirts, dress shirts, T-shirts, jumpers, vests, ties, socks)
- Books
- DVDs
- Posters, drawings and prints
- Mouse mats
- Coasters
- Postcards
- Key rings
- Book marks
- Fridge magnets
- Badges
- Mugs
- Glassware
- Dinnerware
- License plate covers
- Lanyards
- Food (chocolates, fudges, jams)
- Special commemorative or limited edition items

Stock books were generally a small, full-colour, soft-cover book listing each item of rolling stock; its technical specifications, its provenance, any interesting information and a photo. Sometimes these books also covered the railway itself and its operation. These books were generally reasonably cheap.

Line books/booklets were available for a small charge in the UK, and could be in the form of a book, such as the North Yorkshire Moors Railway's, a booklet, such as Severn Valley's, or a pamphlet, such as the West Somerset Railway's. The Durango & Silverton's line book, covering their branch line, mile by mile, is a 188-page book that could be purchased as part of a boxed gift pack along with a DVD about the line. This was, by far, the most comprehensive and (at US $25) the most expensive of these books that I saw.

As the stock books talk about the rolling stock in detail, the line books describe the railway's history and interesting things along the route.

Hats were usually baseball type hats with the company logo on the front, and sometimes the company's website address on the back. These were generally available in a range of colours.

Clothing made up a sizeable portion of many shops. Rugby shirts were popular in the UK—heavy, cotton jersey with a white, button-up collar and the railway's logo above the left breast. Chambray dress shirts were available more widely in the US, again with the logo above the left breast. Logo T-shirts and polo shirts were on sale everywhere, although the US also stocked a range of T-shirts that would appeal more to the enthusiast than to the general public (T-shirts with slogans such as: Still plays with trains). A wide range of jumpers and vests was also similarly available.

Children's sizes were available, and the apparel that was for sale in adult sizes tended to be generally unisex in style and cover both men and women.

The Durango & Silverton Railroad was the exception. Their range of clothing included apparel that would appeal to teenage girls, such as midriff-length pastel pink 'hoodies' with D&SR in large, white-outlined lettering across the front.

Ties were generally only available in the UK. These were a generic tie in a variety of colours with the 'British Rail' logo of a lion on a wheel, and were sold throughout most shops.

A number of operators also sold socks. HSB's socks had the company logo on them, while the S*ir Nigel Gresley* group were selling blue A4 socks.

Calendars were available everywhere. Each operator has its own calendar, depicting its operation. Durango & Silverton sells a CD jewel-cased desktop calendar and many of the UK railways sell slimline format wall calendars. Museums tended to stock calendars published outside: the California State Railroad Museum, for example, stocked an O. Winston Link calendar and a calendar of vintage train travel posters.

Books were available on every conceivable railway topic in every shop. Each railway tended to concentrate on its own particular speciality i.e. narrow-gauge railways stocked narrow-gauge books, Great Western societies had GWR books, the railway at Froissy contained a number of war-railway books.

The Welsh Highlands Railway (Porthmadog) bucked the trend slightly, by carrying an enormous range of books that covered many different gauges and types.

However, in Australia, I would tend to caution about carrying too many railway books or DVDs, as these things tend to interest enthusiasts far more than general public, and enthusiasts are probably more likely to purchase from the Australian Railway Historical Society in the first instance.

DVD stocks again tended to be specific to the railway or type of railway than general interest. One notable DVD was available at the Talyllyn Railway; a 14-minute-long, narrated piece of filming that was taken in 1951 during the first days of the railway under preservation. Although many of the scenes were obviously set up, the quaintness of the production had an undeniable charm.

Posters, drawings and prints were made from colour photos, general arrangements and engineering drawings and prints of paintings. *Mouse mats* were sold from many shops, and were decorated with photos, line drawings and railway logos.

Coasters were available right throughout Europe and the UK and were manufactured from vinyl with a printed photo or logo, cork-backed wood with line drawings, and slate with the railway logo or photograph on the front. The slate coasters were available in Wales, renowned for its slate mining, and these in particular seemed to be a popular item among visitors.

Postcards were on sale at every museum and railway. Particularly useful were the cards that showed some of the more difficult to photograph items, such as the Big Boy at the Forney Transport Museum.

Key rings were manufactured from enamelled metal, etched or engraved metal and plastic enclosed photographs or drawings. *Bookmarks* were popular at the National Railway Museum at York and Locomotion at

Shildon, where a selection of laminated, stylised drawings of locomotives were on sale, along with a *Flying Scotsman* bookmark with a coloured drawing of the locomotive on one side, and a general arrangement line drawing on the other. *Magnets* were also popular, and included photo magnets, and magnets made from natural products such as wood and slate. The most popular kinds of *badges* were enamelled metal pin badges rather than cloth badges that require sewing. Railway logos and stylised locomotives were depicted. All of these were relatively low cost items.

Mugs decorated with photos, drawings, railway logos or vintage posters were available at most places. *Glassware* was etched, engraved or printed with company logos. *Dinnerware and coffee/tea sets* were available at the California State Railroad Museum, which was reproducing two of the designs used aboard dining trains.

License plate covers were widely available in the US, and the Durango & Silverton Railroad had these for sale, decorated with a stylised train along the bottom and the company's contact details along the top. These were similar to the license plate covers that come with the car seller's details in Australia.

Lanyards have become a popular and relatively low-cost souvenir item. As something that many office workers, in particular, need to wear on a daily basis to carry their work ID and access cards, this is easy advertising.

The UK railways sold a range of *chocolates and fudges* that were produced by a fundraising company, and packaged with that railway's branding. The Durango & Silverton Railroad had bars of chocolates packaged with their own wrapper available for sale on their trains, and also had their own blend of *coffee* that was specially prepared for them by a local coffee shop and available only through their buffets. All hot drinks on this railway were served in specially printed hot cups.

Commemorative and limited edition items tend to be the very high-cost end of the market. The National Railway Museum sells replica builder's plates from *Mallard* and *The Flying Scotsman* as well as items such as jewellery and cufflinks made from melted down parts of *Flying Scotsman* to help with its current overhaul.

Commemorative coins were on sale at a number of places and came via a variety of means. The most popular throughout Europe and the US was the vending machine type that 'stamps' the design on a coin for a fee. Rigibahn had a number of different commemorative coins for sale in their shop on a cardboard back, enclosed in plastic.

RESTAURANTS, CAFES AND PUBS: These are big money earners for most organisations, and there were almost as many variations on the type of eating facility available as there were organisations. Le P'tit train de la Haute Somme is only open after lunch, and so their small cafe, with an eating area on a balcony overlooking the platform, only catered for afternoon tea. Railways that are open throughout the day catered for morning and afternoon teas and lunch (and sometimes dinner), and the food available ranged from short-order, hot meals, such as pasties and salad at West Somerset Railway's Brunel Buffet carriage at Minehead, to full hot meals, such as at the Ffestiniog's pub at Porthmadog Station, and hot buffets, available at the Bluebell and at the Talyllyn. Strasburg Railroad serves hot lunches on board its lunch trains, but only cold snacks at its station, and the Cass Scenic Railroad has a large diner at Cass that serves full hot meals.

At all locations except for Froissy, the cafes, restaurants and bars were staffed by paid employees rather than volunteers, and the Welsh Highlands Railway (Porthmadog) had tried to use volunteers, but found the experience unprofitable. Their cafe is now leased out to a third-party and does a good trade.

Some organisations have chosen not to compete with their local food providers; the North Yorkshire Moors Railway only sells cold snacks at its station kiosks—rather than compete with the Goathland Hotel (the Aidensfield Arms of Heartbeat fame) and the fish and chip shops and restaurants of the seaside town of Whitby—and the California State Railroad Museum sells no food at all—the museum is on the edge of the vibrant 'Old Town' area of Sacramento, full of cafes and restaurants and the museum was unable to operate their own cafe at a profit. The Welsh Highlands Railway (Porthmadog) found they couldn’t operate their cafe using volunteer labour at a profit, and so leased that business out, and it now does a reasonable trade. The old silver mining town of Silverton relies on the tourist traffic brought in by the Durango & Silverton Railroad, and so the railroad only sells snacks on board in an effort to have passengers spend their lunch money in Silverton.

RECOMMENDATION: Each organisation should consider a proper cafe or restaurant facility that provides good, healthy food at a reasonable price for a number of reasons. Firstly, the money made from these sales is generally substantial, and keeps the tourists within the boundaries of that location during lunch instead of spending their money elsewhere. It also makes an organisation look more attractive to the casual visitor, who knows that not only can they find entertainment at the railway or museum, but they can purchase a good meal and have an enjoyable lunch.

In order for this to be successful, however, the food must be of a high quality and the kitchen and wait staff must be properly trained. For this reason, all hot-meal restaurants and bars were staffed by paid employees rather than volunteers. Organisations without paid staff in these roles generally only served sandwiches and cold snacks at their cafes and kiosks.

Those railways with a licensed bar—such as the Ffestiniog’s Spooner’s Bar or the Ravenglass & Eskdale Railway’s Ratty Arms in Ravenglass—are not only attracting trade from their passengers, but also the local trade, which is incredibly profitable. Licensing laws in Australia, however, may make the licensing option more difficult to achieve.

CONTRACT WORK: Organisations such as Strasburg Railroad, the Severn Valley Railway and Ffestiniog Railway do a lot of contract work for other organisations, particularly major rebuilding and boiler work that is difficult for some smaller railways to manage. Talyllyn builds air compressors as a speciality, and West Somerset Railway’s restoration workshop at Williton takes on engineering work of all kinds, not simply railway-related contracts.

HIRING OUT LOCOMOTIVES: For organisations with more locomotives than they need for their own purposes, or that have locomotives that are not appropriate for use on their own lines, another option for making money is to hire these engines out for use on other lines. Bluebell Railway, for example, charges between £600 and £700 per day for the use of its locomotives on another line.

FOOTPLATE EXPERIENCE PROGRAMS: Many railways overseas run these programs. They range from a simple ride on in the cab of a locomotive, to a full two-week course learning to drive and fire, and the cost of them ranges from around AU $450 to over AU $2000. Extremely popular with enthusiasts, these experience programs often sell out twelve months in advance. They are, however, often incredibly stressful on the crews, who regularly find themselves in the position of trying to control people who often believe they already know all there is to know about steam locomotive operations. Crews on the Harzschmalspurbahn have an added stress that many of the enthusiasts that sign up for their courses are English speakers, not German speakers, so the the language barrier is an issue of its own.

While some railways allow their students of these programs to drive a normally timetabled service train, carrying passengers, others schedule a special train for these events.

VISITOR ACCESS: Most organisations had controlled public access to the workshops and yards, allowing a peek behind the scenes; something that seems to be very popular with enthusiasts and general public alike. North Yorkshire Moors’ public access was free of charge, although donations boxes were prominently displayed along the path. Bluebell charged for entry to the station and to visit the workshops unless visitors were riding on the train. Durango & Silverton, Jamestown and HSB charge a small amount for conducted tours, and the Welsh Highlands Railway (Porthmadog) includes a workshop tour as part of their train ride.

Harzschmalspurbahn (HSB) also has a viewing platform at the end of the station platform at Wernigerode, overlooking the stabling yard and allows the public excellent views of locomotive preparation for the day's duties. A series of labels around the viewing platform gives the technical specifications and a brief description of each of HSB's different locomotive types for added value to the experience. The National Railway Museum at York and its outpost, Locomotion at Shildon, had mezzanine viewing areas of their conservation workshops that were free of charge. Although these organisations do not make money directly from allowing visitors to see behind the scenes, the workshops manager at the NRM told me that much of their tooling and equipment in the workshop had been donated by visitors after having watched the work underway, and HSB's viewing platform acts as an enticement to ride on their trains.

OUTSIDE SUPPORT: The value of outside support to each of the organisations that I visited cannot be overstated. Organisations in countries that are members of the European Union can apply for EU grants, although some organisations that I spoke to suggested that the paperwork needed to apply for one of these and the number of restrictions in place on use of the money renders these grants less effective than what might be expected.

The Heritage Lottery Fund (HLF) in the UK is a major source of funding for all heritage projects, not just for preserved railways. A non-departmental body, the HLF distributes a share of the income derived from the National Lotteries to a range of heritage-based projects. The body has awarded over £4 billion in grants to 27,000 projects since it was first set up in 1994. Organisations that apply for Heritage Lottery grants must be able to provide a percentage of the total required, which can be in either cash or kind (including the value of volunteer labour). The amount of money that the applicant must put toward the project depends on the size of the grant application and the project. HLF also funds a training bursary scheme for skills transfer (see separate item under training).

HSB is a beneficiary of an association of two states, three counties and many towns and villages, who understand the tourist benefit that the railway brings to the region, and who support the railway through corporate funding. Although I was unable to ascertain from my visit exactly how much money is given to HSB each year through this scheme, my host assured me that it is substantial, and that the railway couldn't meet its obligations (particularly with EU boiler maintenance requirements) without this support.

Severn Valley Railway has a special deal with a local building society that gives them a bonus of 1 per cent of the interest earned by each special Severn Valley Railway account held by the building society.

FRIENDS, ASSOCIATIONS AND FOUNDATIONS: Associations, foundations and friends groups are set up as a charity arm of the railway company or museum, and they sell memberships, fundraise, seek sponsorship, sell merchandise and operate trains, and hold this money in trust until it is required. As charities, the monies raised or held by these organisations is subject to sless tax than it would had it been 'earned' by the company.

For government organisations whose budgets are 'zeroed' at the end of each financial year, such as the National Railway Museum, money that has been raised for major or special projects is safe. The NRM's friends group is run by volunteers, and has put funding towards the current reconstruction work being done on *The Flying Scotsman.*

The California State Railroad Museum has a similar group, which they call a foundation, run by paid staff. The foundation puts around US $3 million back into the museum each year, funding staffing positions and projects. Its money comes from grants, the train rides operated by the museum and from merchandising sales in the shop, which alone accounts for 40 per cent.

CONCLUSIONS

Heritage and tourist railway organisations in Australia have a lot we could learn from similar organisations in Continental Europe, the United Kingdom and in the United States of America. Admittedly, overseas organisations all have an advantage in population/area, and people in the United Kingdom, in particular, have a passion for their heritage and for steam railways that is not so prevalent here.

Despite this, there are a number of ways that Australian organisations could improve their maintenance, restoration, operation, conservation, and interpretation of steam locomotives that are within the reach of many railways.

Many heritage railway organisations in Australia would benefit from a single, national framework for their boiler maintenance and operation, and their mechanical maintenance, which would lift the burden of designing these procedures from the shoulders of staff and volunteers, many of whom do not have the time or the capacity to develop their own.

All organisations would benefit from a heritage funding scheme, similar to the UK's Heritage Lottery Fund, to assist them achieve major goals and in projects with heavy expenditure.

Organisations would benefit from either a national training scheme to help transfer those traditional railway skills that are fast disappearing, or a bursary funding scheme to allow dedicated maintenance staff and volunteers to attend training with other organisations, both in Australia and overseas. Organisations would also benefit from an informal association of maintenance managers to allow an easy sharing of information between groups.

All heritage railway groups need a clear understanding on what their organisation's over-arching philosophy is and what their stance is on the treatment of their locomotives, using documents such as the Riga Charter for a foundation.

Travelling bunker-first, the Harzschmalspurbahn locomotive hauls its train through the streets of Westerntor on its way back to Wernigerode in the afternoon.

RECOMMENDATIONS

In order for heritage railways to operate in a safe and sustainable manner

I recommend that government bodies:

- Set aside some of the money made from national lotteries and use this to fund heritage projects
- Implement a mandatory, enforceable, national set of regulations in boiler management and mechanical management of steam locomotives, phased in over a number of years, that would be required across the board and make compliance with this a prerequisite of accreditation. The committee developing these regulations should be available to heritage organisations to hear their issues with the regulation requirements, and the regulations should be regularly reviewed and updated, as neccessary.
- Set up a national body to inspect and enforce these regulations, or ensure that regulators have auditing inspectors with a background in the field
- Continues to allow the current practice of Australian operators and maintenance professionals inspecting their locomotives and rolling stock for their fitness to operate
- Provide information sessions for boiler inspectors who wish to refresh their heritage locomotive boiler inspection skills, or to assist inspectors not currently working within the heritage steam locomotive sector to gain some background in the area
- Implement training schemes in boilermaking and mechanical fitting in line with the regulations or fund a series of traineeships to send appropriate candidates overseas to learn skills
- Set up mentoring groups where organisations with the skills and understanding of the regulations can assist fledgling organisations by providing support and information

I recommend that heritage railways:

- Develop and implement a philosophy for operation and each piece of rolling stock
- Set up a network of maintenance workers with regular, informal meetings to share information
- Ensure a thorough understanding of the safe operation of their railway and rolling stock
- Ensure they have a thorough understanding of their responsibilities, the regulations and are able to implement them
- Ensure that paid and voluntary staff are qualified for the work they are doing
- Implement training schemes for both paid and voluntary staff to ensure skills transfer
- Implement a system of paperwork to track faults and repairs
- Ensure that money is available for repairs, maintenance and overhaul of rolling stock

I recommend that railway museums:

- Develop an organisational philosophy
- Develop and implement an appropriate collections policy
- Develop and implement an appropriate philosophy for each object

INFORMATION AND DISSEMINATION

The information within this report was collected to assist railway organisations inform themselves of best practices overseas, so that they may take those lessons most useful to them and implement them in a manner most applicable to their groups.

This report will be sent to the Office of Rail Heritage, the Association of Tourist and Heritage Railways Australia and the Australian Railway Association in the hope that some of the broader concepts within this report may find support within government bodies and organisations.

The information gathered for this report—including that which has not been covered in this report because it was not strictly on topic—can be presented or otherwise made available to heritage rail industry forums and railway groups on request, and further information will be made available where possible through industry journals and magazines.

APPENDIX A
TRANSCRIPT OF THE RIGA CHARTER

INTRODUCTION: This charter has been created to guide decisions that will result in heritage railways being able to ben enjoyed by future generations.

Heritage railways have been very successful in rescuing, restoring, preserving and operating historic equipment.

We hope that this charter will help everyone involved to see opportunities for making wise decisions.

It has been created to accompany the several other charters relating to heritage conservation.

PURPOSE: The Riga Charter is a statement of principles which guide the conservation, restoration, maintenance and repair and use of historic railway equipment, which is being operated. It is hoped that this will help our members make wise decisions.

DEFINITIONS:
Heritage Railways referred to in this Charter, may also include historic or preserved railways, museum railways and tramways, working railway and tram museums and tourist railways, and may extend to heritage trains operating on the national network and other railways.

Railway Equipment referred to in this Charter may include buildings of infrastructure which form part of the railway ensemble.

Preservation is the process of keeping an object safe from harm and decomposition, by maintaining it properly so that its condition, quality and memory is retained.

Conservation is the process of stabilising the condition of an object without compromising the historical or material evidence in any way.

Restoration is the process of repairing or replacing missing parts in an attempt to regain an earlier state of the object. The restoration may increase the strength of the object before work started, and may generally go further than conservation. It should neither be invisible or glaringly obvious.

Repair is the process of adjustment or replacement of the components. The specified standard of mechanical condition is achieved irrespective of the historic integrity of parts that may be altered or discarded.

Article 1

Scientific and technical skills, together with the facilities needed to preserve and operate historic railway equipment, within a culture of safety, should be used to safeguard railway heritage.

Article 2

The aim of preserving and restoring historic railway items and associated working practices is to safeguard them, whether they are significant technological artefacts, evidence for transport history or a means of perpetuating traditional skills.

Article 3

Maintenance of all aspects of their equipment, and operation on a regular basis is essential for the survival of heritage railways. Operating historic and valuable railway equipment with traditional operating procedures, and presenting it to the public, is an important means of interpreting that material.

Article 4

Identifying socially useful purposes for historic railway items will help facilitate their preservation, but such use should involve the minimum change necessary, and such changes should be fully reversible.

TRANSCRIPT OF THE RIGA CHARTER CONT.

Article 5

A heritage railway should reflect not only the importance of its own role as a transport system, but also when appropriate, its own historic origins and its impact on the community.

Article 6

The process of restoration is a highly specialised operation. Its aim is to preserve and reveal the aesthetic, functional and historic value of traditional railway equipment.

Article 7

The original or historically correct materials and techniques should be used in the conservation of historic railway items, unless they can no longer be adopted for reasons of safety, legislation or availability. In such cases appropriate contemporary substitutes for such materials or techniques should be used.

Article 8

The restoration of a piece of historic railway equipment does not require that it must be restored to its original as-built sate. Some equipment acquires its historic importance later on its working life. Restoration to any period should be executed only after thorough consideration of historic records, and available documentation covering the chosen period, after which a restoration plan should be written and adopted. Material that is replaced with new should be readily identified as such with a simple permanent marking system.

Article 9

Added mandatory safety equipment should, if possible, blend harmoniously with the conserved or restored item, but the fact that it is an addition or alteration to the original make-up of the item should be clearly indicated.

Article 10

Any other necessary later modifications to the item that are introduced for whatever reason should be as sympathetic as possible to the make-up and appearance of the original item. Ideally any such modification should be reversible and any significant original parts removed should be retained for possible future re-use.

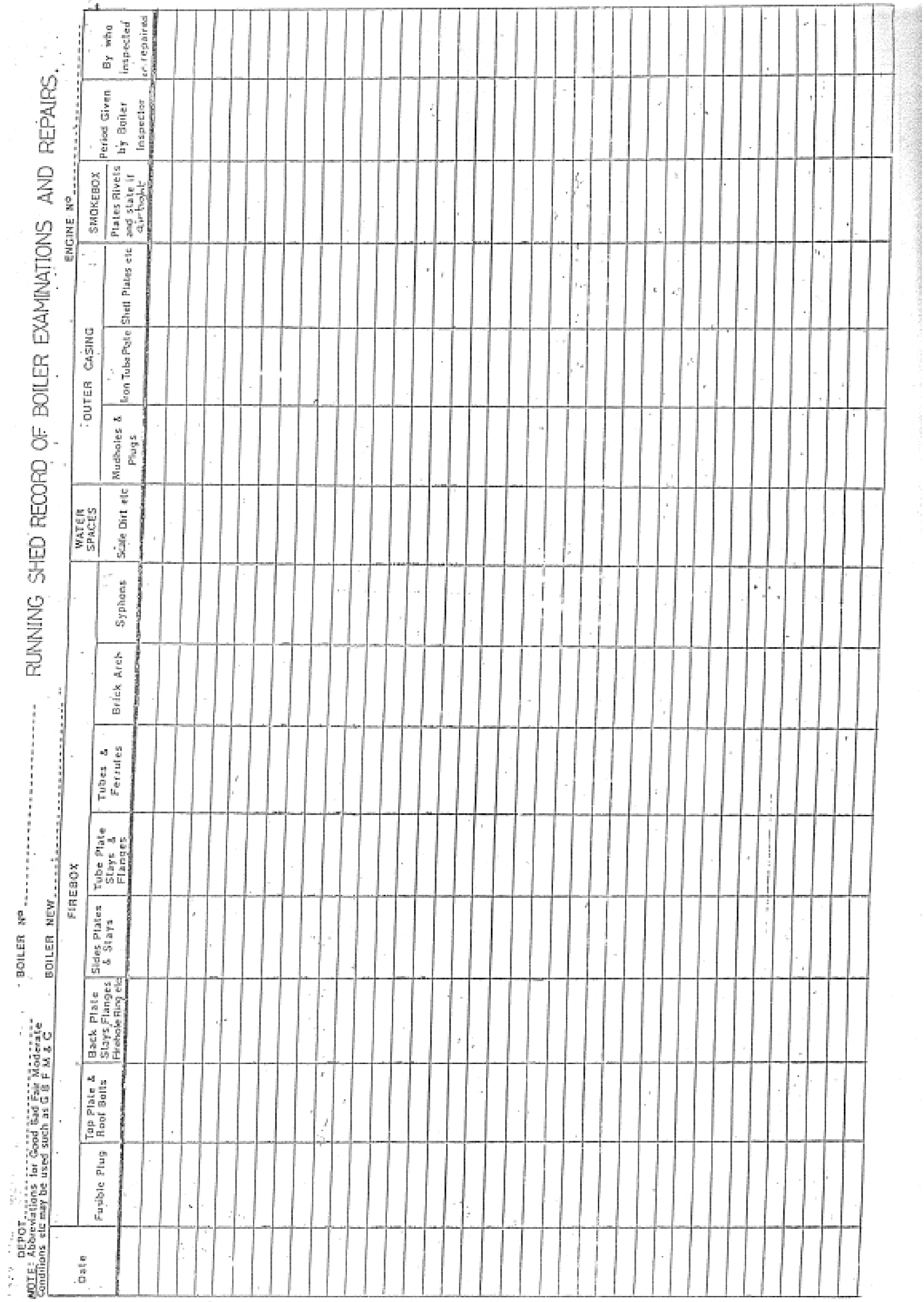
Article 11

Every stage in the conservation or restoration work on historic railway item should be systematically planned and recorded. The resultant record of these processes retained for a minimum of the life of the item.

Article 12

All bodies involved in the repair, restoration, maintenance, conservation and operation of heritage railways and railway equipment, must make proper arrangements for the conservation of their records and archives.

APPENDIX B
SEVERN VALLEY RAILWAY'S
RUNNING SHED BOILER EXAMINATION AND REPAIR REGISTER
FRONT



DEPOT .... BOILER No .... RUNNING SHED RECORD OF BOILER EXAMINATIONS AND REPAIRS. ENGINE No ....

NOTE: Abbreviations for Good Bad Fair Moderate Conditions etc may be used such as G B F M & C

BOILER NEW ....

Date	FIREBOX								WATER SPACES	OUTER CASING			SMOKEBOX	Period Given by Boiler Inspector	By who inspected or repaired
	Fusible Plug	Top Plate & Roof Bolts	Back Plate Stays, Flanges Firehole Ring etc	Sides Plates & Stays	Tube Plate Stays & Flanges	Tubes & Ferrules	Brick Arch	Syphons	Scale Dirt etc	Mudholes & Plugs	Iron Tube Plate	Shell Plates etc	Plates Rivets and state if airtight		

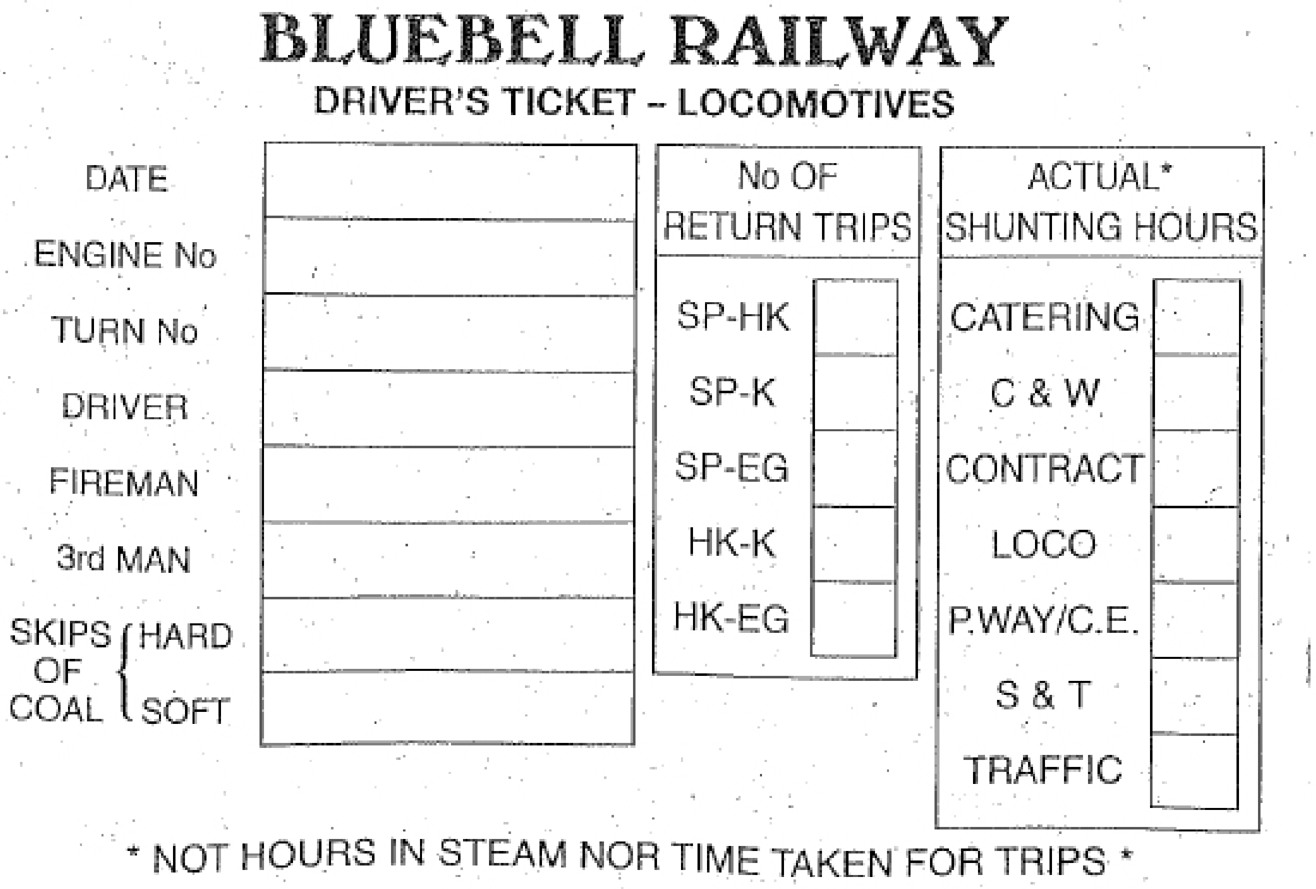
SEVERN VALLEY RAILWAY'S
RUNNING SHED BOILER EXAMINATION AND REPAIR REGISTER
REVERSE

DATE	REPAIR	INIT'L'S

DATE	REPAIR	INIT'L'S

DATE	REPAIR	INIT'L'S

Appendix C
Bluebell Railway Driver's Daily Locomotive Ticket
Front and Reverse



BLUEBELL RAILWAY

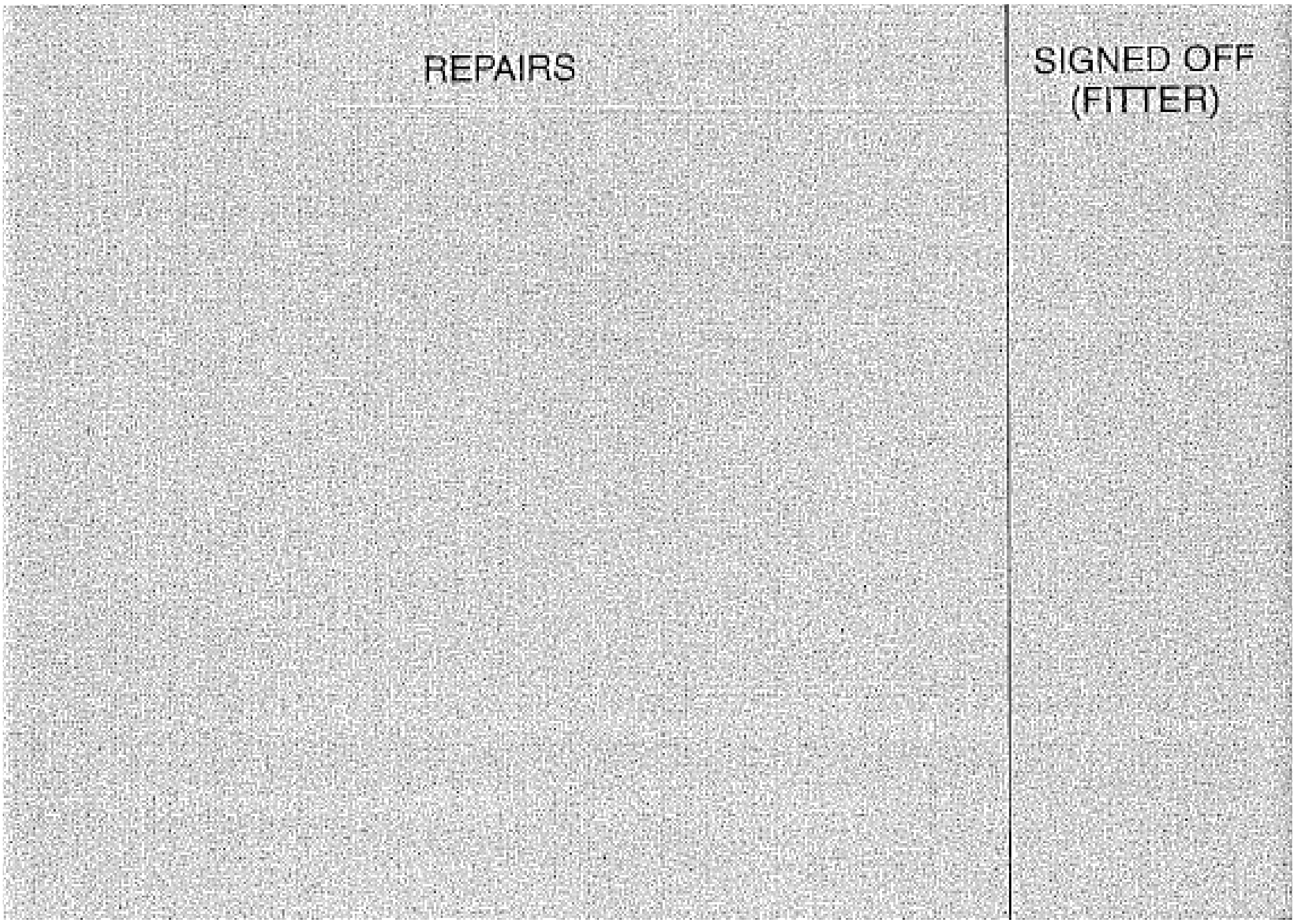
DRIVER'S TICKET – LOCOMOTIVES

DATE	
ENGINE No	
TURN No	
DRIVER	
FIREMAN	
3rd MAN	
SKIPS OF COAL HARD	
SKIPS OF COAL SOFT	

No OF RETURN TRIPS	
SP-HK	
SP-K	
SP-EG	
HK-K	
HK-EG	

ACTUAL* SHUNTING HOURS	
CATERING	
C & W	
CONTRACT	
LOCO	
P.WAY/C.E.	
S & T	
TRAFFIC	

* NOT HOURS IN STEAM NOR TIME TAKEN FOR TRIPS *



REPAIRS	SIGNED OFF (FITTER)